SIBOGA-EXPEDITIE.

Siboga-Expeditie

UITKOMSTEN

OP

ZOOLOGISCH, BOTANISCH, OCEANOGRAPHISCH EN GEOLOGISCH GEBIED

VERZAMELD IN

NEDERLANDSCH OOST-INDIË 1899—1900

AAN BOORD **H. M. SIBOGA** ONDER COMMANDO VAN

Luitenant ter zee 1e kl. G. F. TYDEMAN

UITGEGEVEN DOOR

Dr. MAX WEBER
Em. Prof. in Amsterdam, Leider der Expeditie

(met medewerking van de Maatschappij ter bevordering van het Natuurkundig Onderzoek der Nederlandsche Koloniën)

BOEKHANDEL EN DRUKKERIJ
VOORHEEN
E. J. BRILL
LEIDEN

APR 1954
LIBRARY
POFI
FISH & WILDLIFE
SERVICE

Siboga-Expeditie
VI

THE HEXACTINELLIDA OF THE SIBOGA EXPEDITION

BY

ISAO IJIMA, PH. D.,
RIGAKUHAKUSHI,
Late Professor of Zoölogy, Sci. Fac., Tokyo Imperial University

With 26 plates and 36 textfigures

LATE E. J. BRILL
PUBLISHERS AND PRINTERS
LEIDEN — 1926

Q115
S1
No.6-6a

Edited in memory of the lamented Prof. I. Ijima, the celebrated author of this most valuable Report, the last work with which he enriched his beloved science.

Max Weber.

The late Professor ISAO IJIMA was for more than ten years engaged in the study of Hexactinellids obtained by the Siboga expedition. This work was unfortunately brought to an end by his untimely death on March 14th, 1921. Under the pressure of his extensive administrative work, Professor IJIMA could devote only a limited part of his time to this study. Nevertheless the work was nearly or quite ready for publication. Only the second half of the manuscript was left by him without final revision.

After Professor IJIMA's death responsibility fell upon his assistant, Mr. YAICHIRO OKADA, to put the manuscript into the present form.

TOKIO KABURAKI.

CONTENTS.

Page

I. INTRODUCTORY 1

II. SYSTEMATIC 4

Suborder I. **AMPHIDISCOPHORA** F. E. Sch., 1899. 4

Fam. 1. PHERONEMATIDAE J. E. Gray, 1870, emend. . 7

Genus **Pheronema** Leidy, 1868 9

1. *Ph. giganteum* F. E. Sch., 1886 10

2. *Ph. weberi* n. sp. 17

3. *Ph. echinatum* n. sp. 21

Genus **Sericolophus** Ij., 1901. 25

1. *S. reflexus* (Ij., 1894) 26

Genus **Semperella** J. E. Gray, 1868 28

1. *S. similis* n. sp. 28

Fam. 2. MONORHAPHIDIDAE n. fam. 36

Genus **Monorhaphis** F. E. Sch., 1904 37

1. *M. chuni* F. E. Sch., 1904 37

Fam. 3. HYALONEMATIDAE J. E. Gray, 1857, emend. . 41

Genus **Chalaronema** n. g. 43

1. *Ch. sibogae* n. sp. 43

Genus **Hyalonema** J. E. Gray, 1832 49

1. *H.* (*Euhyalonema*) *intermedium* n. sp. 55

2. *H.* (*Euhyalonema*) *keianum* n. sp. 58

3. *H.* (*Pteronema*) *topsenti* n. sp. 61

4. *H.* (*Coscinonema*) *kirkpatricki* n. sp. 68

5. *H.* (*Cyliconema*) *apertum maehrenthali* F. E. Sch., 1895. 72

6. *H.* (*Cyliconema*) *timorense* n. sp. 88

7. *H.* (*Cyliconema*) *keiense* n. sp. 90

8. *H.* (*Paradisconema*) *vosmaeri* n. sp. 93

9. *H.* (*Leptonema*) *flagelliferum* n. sp. 97

10. *H.* (*Thamnonema*) *thamnophorum* n. sp. 99

11. *H.* (*Corynonema*) *rotundum* n. sp. 102

Indeterminable Hyalonematids 104

Suborder II. **HEXASTEROPHORA** F. E. Sch., 1899. 105

Tribe A. HEXACTINOSA Schram., 1910—12 . . 113

Subtribe a. CLAVULARIA F. E. Sch., 1886 . . 129

Fam. 4. FARREIDAE F. E. Sch., 1886 129

Genus **Farrea** Bwbk., 1862 130

1. *F. occa erecta* n. subsp. 132

2. *F. occa clavigera* F. E. Sch., 1886 137

3. *F. occa subclavigera* n. subsp. 140

4. *F. occa mammillata* n. subsp. 142

5. *F. occa cuspidata* n. subsp. 145

6. *F. occa ouwensi* n. subsp. 148

7. *F. hanitschi* n. sp. 151

8. *F. nodulosa* n. sp. 154

9. *F. spirifera* n. sp. 156

10. *F. lendenfeldi* n. sp. 159

Indeterminable Farreids 161

Subtribe b. SCOPULARIA F. E. Sch., s. ext. . . . 163

Fam. 5. EURETIDAE F. E. Sch., s. ext. 163

Genus **Eurete** Semper, 1868. 166

1. *E. marshalli* F. E. Sch., 1886. 167

2. *E. trachydocus* n. sp. 168

3. *E. schmidti treubi* n. subsp. 170

4. *E. schmidti kampeni* n. subsp. 173

5. *E. freelandi* n. sp. 176

Genus **Pararete** n. g. 178

1. *P. farreopsis farreopsis* (Carter, 1877) 178

2. *P. farreopsis fragiferum* n. subsp. 182

3. *P. farreopsis subglobosum* n. subsp. 183

4. *P. farreopsis jakosalemi* n. subsp. 185

5. *P. baliense* n. sp. 187

6. *P. kangeanganum* n. sp. 189

7. *P. freeri* n. sp. 190

8. *P. semperi* (F. E. Sch., 1886) 193

Indeterminable *Eurete* or *Pararete* 195

Genus **Pleurochorium** Schram., 1910—12 . . . 195

1. *Pl. cornutum* n. sp. 197

Genus **Periphragella** Marsh., 1875 203

1. *P. parva* n. sp. 205

2. *P. irregularis* n. sp. 208

Genus **Lefroyella** W. Thoms. 1877 210

1. *L. ceramensis* n. sp. 210

Genus **Myliusia** J. E. Gray, 1859. 213

1. *M. callocyathus* J. E. Gray, 1859 215

2. *M. verrucosa* n. sp. 217

Fam. 6. TRETODICTYIDAE F. E. Sch., 1886 . . . 218

Genus **Tretodictyum** F. E. Sch., 1886, emend. . . 220

1. *T. tubulosum* F. E. Sch., 1886. 221

2. *T. schrammeni* n. sp. 224

3. *T. pumicosum* n. sp. 229

page

Genus **Hexactinella** Carter, 1885 231
1. *H. lata* (F. E. Sch., 1886) 235
2. *H. rugosa* n. sp. 237
3. *H. vermiculosa* n. sp. 239
4. *H. lingua* n. sp. 242
5. ?*H. spongiosa* n. sp. 246
Genus **Sclerothamnopsis** H. V. Wils., 1904. . . 248
1. *S. schulzei* n. sp. 249
Genus **Sclerothamnus** Marsh., 1875 253
1. *S. clausi* Marsh., 1875. 253
Genus **Psilocalyx** n. g. 265
1. *Ps. wilsoni* n. sp. 265
Genus **Anomochone** n. g. 268
1. *A. expansa* n. sp. 269
2. *A. globosa* n. sp. 272
Fam. 7. AULOCALYCIDAE n. fam. 274
Genus **Rhabdodictyum** O. Schm., 1880 . . . 276
1. *R. kurense* n. sp. 277
Genus **Tretopleura** n. g. 280
1. *T. candelabrum* n. sp. 281
Fam. 8. APHROCALLISTIDAE J. E. Gray, 1867 . . 284
Genus **Aphrocallistes** J. E. Gray, 1858. . . . 286
1. *A. beatrix* J. E. Gray, 1858. 286
Fam. 9. CRATICULARIDAE Rauff, 1893 297
Genus **Tretorete** n. g. 298
1. *T. incertum* n. sp. 298
Tribe B. LYCHNISCOSA Schram., 1903 . . . 299
Fam. 10. AULOCYSTIDAE F. E. Sch., 1904 . . . 301
Genus **Aulocystis** F. E. Sch., 1886 302
1. *A. zitteli zitteli* (Marsh. & Mey., 1877) 304
2. *A. zitteli sibogae* n. subsp. 305
Fam. 11. DIAPLEURIDAE n. fam. 314
Genus **Diapleura** n. g. 314
1. *D. maasi* n. sp. 314
Indeterminable Lychniscosa 317
Tribe C. LYSSACINOSA n. tr. 319
Fam. 12. LEUCOPSACASIDAE Ij., 1903 320
Genus **Leucopsacas** Ij., 1903 320
1. *L. scoliodocus* Ij., 1903. 321
Genus **Chaunoplectella** Ij., 1903. 323
1. *Ch. stelleta* n. sp. 323
Fam. 13. EUPLECTELLIDAE (Gray) Ij., 1903. . . 326
Subfam. EUPLECTELLINAE Ij., 1903 326
Genus **Euplectella** Owen, 1841 327
1. *E. timorensis* n. sp. 327
Subfam. CORBITELLINAE Ij., 1903. 334
Genus **Regadrella** O. Schm., 1880 335
1. *R. cylindrica* n. sp. 335
Genus **Bolosoma** F. E. Sch., 1904. 340
1. *B. cavum* n. sp. 340
Indeterminable Euplectellids 344
Fam. 14. CAULOPHACIDAE Ij., 1903 345
Genus **Caulophacus** F. E. Sch., 1886 346
1. *C.*? sp. 346
Fam. 15. ROSSELLIDAE (F. E. Sch.) Ij. 1903 . . 347
Subfam. LANUGINELLINAE F. E. Sch., 1897. . . 347
Genus **Lophocalyx** F. E. Sch., 1886 348
1. *L. suluanus* n. sp. 348
Subfam. ROSSELLINAE F. E. Sch., 1897. . . . 353
Genus **Bathydorus** F. E. Sch., 1886 353
1. *B. pedunculatus* n. sp. 353
Subfam. ACANTHASCINAE F. E. Sch., 1897 . . . 355
Genus **Staurocalyptus** Ij., 1897 355
1. *S. celebesianus* n. sp. 355

III. LIST OF SIBOGA STATIONS AT WHICH HEXACTINELLIDS WERE OBTAINED, WITH MENTION OF THE FORMS COLLECTED AT EACH 358
IV. LIST OF RECOGNIZABLY KNOWN RECENT HEXACTINELLIDS ARRANGED SYSTEMATICALLY 364
V. LIST OF LITERATURE REFERRED TO IN THIS REPORT 378
VI. ALPHABETICAL INDEX TO SCIENTIFIC NAMES GIVEN IN THIS REPORT. 382
EXPLANATION OF THE PLATES.

I. INTRODUCTORY.

The Hexactinellids collected by the "Siboga", it was originally arranged by Professor MAX WEBER, the leader of the Expedition, to be examined and reported on by Professor F. E. SCHULZE of Berlin. Their study was actually commenced by that eminent spongologist, but owing to a lamentable circumstance in the health of his sight, it seemed to him necessary to forego the continuance of the work. Thereupon, in 1907, it fell into my lot to be asked by Professor WEBER to undertake the work. The privilege thus offered was gladly accepted by me, for, engaged as I was and am still in the study of the Hexactinellids of the Japanese seas, those of the territory covered by the "Siboga" Expedition aroused deepest interest in me. Keenly alive as I since always have been to the responsibility involved, the task of bringing this report into completion was greatly delayed, owing to the pressure of unavoidable circumstances, for which I cannot refrain from expressing my sincere regret.

Here I beg to tender my warmest thanks to Professor WEBER not only for the honour of being allowed to participate in the collaboration of so monumental a work, but also for the patience he has shown pending the final submittal of this report. My thanks are also due to Professor F. E. SCHULZE for courteously handing over to me numerous useful *Hyalonema* preparations which he had made from the "Siboga" material while this had been in his hand. To Dr. R. HANITSCH, of the Raffles Museum in Singapore, I am indebted for the gift of several beautiful Hexactinellids (*Farrea hanitschi* n. sp., *Pararete farreopsis subglobosum* n. subsp., *Tretodictyum tubulosum* F. E. Sch. and *Aulocystis zitteli sibogae* n. subsp.) which were originally collected by Mr. MACLEAR LADDS from retrieved submarine cables in Timor and China Seas, and the description of which I have embodied in this report in view of the relative proximity of their localities to the area worked by the "Siboga". Finally I deem it only proper to gratefully acknowledge the fact that the investigation was done throughout in, and availing of the facilities afforded by, the Zoological Institute of the Science Faculty, Imperial University of Tokyo. The final preparation of the figures of spicules for publication in this report was done with most conscientious care by Mr. I. SAKUMA, draughtsman in the Zoological Institute. The photographic work was attended to in part by the late Mr. R. UCHIYAMA and in part by Mr. T. MATSUO of the same Institute.

The entire "Siboga" collection of Hexactinellids was delivered to me by Professor F. E. SCHULZE in some sixty-five glass bottles and tubes of various sizes and in nineteen small boxes and cans. The specimens were for the most part in alcohol, and the small rest in the

dried state. Exceedingly important and valuable as the collection proved to be, most individual specimens in it were found to be, it must be said, not in as satisfactory a stare of preservation as might be desired, apparently largely due to the fact that the collecting was done nearly exclusively by means of the trawl or the dredge, which apparatus are, as may easily be imagined, too apt to bring up such delicate objects as Hexactinellids broken into fragments or badly mutilated, or soiled by mud. Moreover, it was found that, of those specimens which have retained the soft tissues, scarcely any could be said to have preserved these in a really good state, a fact which made me nearly altogether relinquish the histological investigation, but confine my attention to the gross morphology and spiculation as basis for the systematic.

Specimens of Hexactinellida were collected by the "Siboga" at 50 stations of the total number of her 363 stations in the Indo-Australian seas. The station of greatest depth where any Hexactinellid was obtained was Stat. 221 (south-east of Binongka I. in Banda Sea), 2798 m. deep, the forms being *Hyalonema flagelliferum* n. sp., *H. thamnophorum* n. sp. and an indeterminable Hyalonematid represented by an isolated root-tuft. In the list of "Siboga" stations there are counted 25 stations which are of a greater depth, down to 5684 m., than the one just mentioned; but none of these, it seems, have given Hexactinellids. Stations less than 100 m. deep, which yielded Hexactinellids, were Stat. 260 (W. of Great Kei I.) and Stat. 89 (shore-exploration near Kaniungan on the eastern coast of Borneo). The former, 90 m. deep, yielded six forms (*Eurete marshalli* F. E. Sch., *Tretodictyum pumicosum* n. sp., *Hexactinella rugosa* n. sp., *Anomochone globosa* n. sp., *Sclerothamnus clausi* Marsh., *Aulocystis zitteli sibogae* n. subsp.). The latter has given three forms (*Farrea* sp., *Sclerothamnus clausi* Marsh., *Hexactinella vermiculosa* n. sp.); but it is highly probable that those specimens, taken during a shore-exploration and represented as they all are by macerated fragments, had their real origin from a bottom much deeper than the unusually small depth (only 11 m.) ascribed to the station. Here in addition must be noted the relatively shallow spot of 82 m. in Timor Sea. whence came specimens, collected by Mr. MACLEAR LADDS, of *Farrea hanitschi* n. sp. and *Aulocystis zitteli sibogae* n. subsp.

The region of Kei Islands has proved a remarkably rich Hexactinellid ground. Altogether a little over one-half the total number of different determinable forms (species and subspecies) brought home by the "Siboga" is represented in the material obtained at ten stations in that region, ranging in depth from 90 m. to 1788 m. Especially noteworthy is Stat. 251, a spot 204 m. deep and to the south of Kur I., one of the said group of islands, where were obtained twenty-four different Hexactinellid forms in one operation with the trawl. — From amongst other localities which yielded Hexactinellids in some notable abundance may be mentioned especially Stat. 226 (near Schildpad I. in the middle of Banda Sea, 1595 m.) where were obtained ten different forms, and the neighbourhood of Sulu Islands where collecting operations at five stations (275—564 m.) brought up in all eleven different forms.

The "Siboga" collection of Hexactinellids was at first thought by me, and also by Professor WEBER, to be not very extensive. Nevertheless, taking it together with the small collection of MACLEAR LADDS, I have after all made out at least 76 distinguishable forms, of which 61 may be regarded new to science, new species and subspecies numbering respectively 49 and 12. Those 76 forms are presented in this report in 34 genera, of which 7 are new.

The rich number of new forms brought to light by the "Siboga" only makes one ever so much expectant of manifold discoveries which future explorations may yet probably bring about.

The Amphidiscophora described in this report comprises 6 genera and 18 species and subspecies; the Hexasterophora, 28 genera and 58 species and subspecies. Of the latter suborder, 19 genera and 49 species and subspecies are dictyonine, while 9 genera, each represented by a single species, are lyssacine forms. Genus *Hyalonema*, with 11 species and subspecies, stands foremost in the collection as one very strongly represented by different forms. Next to it in the same respect stands *Farrea* with 10 species and subspecies, followed in decreasing order by *Pararete* with 8 species and subspecies, *Eurete* with 5 species and subspecies, *Hexactinella* with 5 or 4 species, and the rest of the genera each with 3—1, but mostly a single, species.

Of special interest are the discoveries by the "Siboga" of a new species of *Pleurochorium*, an Euretid genus hitherto known only as a fossil from the Upper Cretaceous; of *Tretorete incertum*, a new genus and species, which seems to be the only living representative as yet known of the ancient family Craticularidae; and of *Diapleura*, a new genus and family which adds a new type to the living Lychniscosa.

As a result of my studies on not only the Hexactinellids now reported on, but also on those collected by myself in Japan and including not a few forms which are new and will be described elsewhere, I have found necessary to make some rearrangements in the system of the recent Hexactinellida, especially in regard to the families and genera. Here may as well be given a partial indication of the system I have adopted in this work, as follows:

Ord. HEXACTINELLIDA.	Subord. I. **AMPHIDISCOPHORA** F. E. Sch.			Fam. 1. PHERONEMATIDAE J. E. Gray, emend.
				Fam. 2. MONORHAPHIDIDAE, n. fam.
				Fam. 3. HYALONEMATIDAE J. E. Gray, emend.
	Sub. II. **HEXASTEROPHORA** F. E. Sch.	Tribe A. HEXACTINOSA Schram.	Subtribe a. CLAVULARIA F. E. Sch.	Fam. 4. FARREIDAE F. E. Sch.
			Subtribe b. SCOPULARIA F. E. Sch.	Fam. 5. EURETIDAE F. E. Sch.
				Fam. 6. TRETODICTYIDAE F. E. Sch.
				Fam. 7. AULOCALYCIDAE, n. fam.
				Fam. 8. APHROCALLISTIDAE J. E. Gray.
				Fam. 9. CRATICULARIDAE Rauff.
		Tribe B. LYCHNISCOSA Schram.		Fam. 10. AULOCYSTIDAE F. E. Sch.
				Fam. 11. DIAPLEURIDAE, n. fam.
		Tribe C. LYSSACINOSA n. tribe.		Fam. 12. LEUCOPSACADIDAE Ij.
				Fam. 13. EUPLECTELLIDAE Ij.
				Fam. 14. CAULOPHACIDAE Ij.
				Fam. 15. ROSSELLIDAE F. E. Sch.

All the fifteen families given above are represented in the "Siboga" collection of the Hexactinellida.

II. SYSTEMATIC.

Suborder I. **AMPHIDISCOPHORA** F. E. Schulze, 1899.

Hexactinellids with amphidisc, but without hexaster (F. E. Schulze, 1904, p. 180).

The above short definition suffices completely for distinguishing the suborder from the only other Hexactinellid suborder Hexasterophora. But to give some other important common characters of the Amphidiscophora, the spicules are all and always loosely set together (lyssacine), never undergoing ankylosis of any sort; the superficial covering spicules (dermalia and gastralia) are generally pentactine pinules in which the outwardly directed unpaired ray is the pinularly developed; macropentactine hypodermalia, with the unpaired ray dipping into the choanosome, is of a constant occurrence; the sponge is never firmly attached to the substratum, but is rooted by means of a basal tuft or tufts of anchoring needles which are invariably monactins, toothed anchor-like on the morphological spicular centre at their inferior end. Intermedial microhexactin [1]) (microhexactin, micropentactin, etc.) is of a very general occurrence, but may occasionelly be wanting (as f. i. in *Euhyalonema*).

In the Hexactinellidan system last set forth by F. E. Schulze (1904, p. 181), the Amphidiscophora stand as made up of the two families Hyalonematidae F. E. Sch. and Semperellidae F. E. Sch. As distinctive criterion between these families the author depended solely on certain external macroscopic features of the sponge body, without taking into account the spiculation, as follows:

Fam. Hyalonematidae F. E. Sch. "Amphidiscophora mit einem einzigen scharf umgrenzten Ausströmungsbezirke (Gastralfelde)". Comprising seven genera: *Platylistrum* F. E. Sch., *Sericolophus* Ij., *Lophophysema* F. E. Sch., *Pheronema* Leidy, *Poliopogon* W. Thoms., *Hyalonema* J E. Gray, *Compsocalyx* F. E. Sch.

Fam. Semperellidae F. E. Sch. "In der Seitenfläche des langgestreckten, cylindrischen, keulen- oder spindelförmigen Körpers finden sich zahlreiche, von der engmaschigen Dermalmembran umschlossenene (gastrale oder oskulare) Ausströmungsbezirke". Comprising two genera: *Semperella* J. E. Gray, *Monorhaphis* F. E. Sch.

This way of dividing the Amphidiscophora seems to me not recommendable, as being

1) "Holactin" (Kirkpatrick, 1910*a*), a term for triaxon spicules without distal appendages or spines at the end of rays, used riespective of the number of persistent rays and in distinction from the "astral" which comprises the amphidisc and the hexaster.

in a measure unnatural. On the conviction that the spiculation, rather than any macroscopic character, offers on the whole a more reliable basis for the classification, I have come, by utilizing the former alone, to divide the suborder into three families, none of which agrees in scope with the two distinguished by F. E. SCHULZE. The families adopted by me should go by the names of Pheronematidae, Monorhaphididae and Hyalonematidae. Or, one may perhaps as well rank the same three groups as subfamilies (Pheronematinae, Monorhaphinae, Hyalonematinae) under one and the same family (Hyalonematidae J. E. GRAY).

Differential key to the families.

A. Choanosomal supporting spiculas commonly either hexactins or pentactins, or both. Prostals in the form of the sceptre. Basals with bidentate anchor, numerously present but not always forming a distinct tuft or tufts . . . PHERONEMATIDAE J. E. Gray, emend.

B. Choanosomal supporting spicules predominantly in the form of tauactins. Without sceptre. A single, excessively strongly developed basal needle, of which the anchor is unknown . . . . . MONORHAPHIDIDAE, n. fam.

C. Choanosomal supporting spicules either all or in a large proportion reduced to the form of rhabdodiactins; in the latter casse some remaining in the form of macrohexactins. Without sceptre. Basals in a tuft, their anchor consisting of an inverted conical swelling with a circle of several short teeth. . . . . HYALONEMATIDAE J. E. Gray, emend.

The uncinate seems to be constantly present in the Pheronematidae and the Monorhaphididae, but not in most Hyalonematidae, among the Amphidiscophora. Indubitably the same spicule is known to occur also in the Hexactinosa among the Hexasterophora, though not in other tribes of that suborder. It may therefore be assumed that the uncinate is phylogenetically a very old spicule, older than the amphidisc or the hexaster and which must have already existed in the primitive ancestral Hexactinellida before the differentiation into the Amphidiscophora and the Hexasterophora. The spicule in question seems to have passed by inheritance into both these great Hexactinellid branches; and the fact that, while certain forms in both still retain it, others are without it, is probably to be explained by assuming its secondary loss in the latter. In this relation it is a notable fact that, alike in both the suborders, the uncinatophorous species are confined, or nearly confined, in occurrence too within those groups in which the choanosomal supporting megascleres, as distinguished from the microscleres and other choanosomal spicules of a specific function apparently other than the mechanical support of the parts they are found in, either remain in the original hexactine form or bear an indication of relative primitiveness in being never so much reduced in the number of their rays as to be rhabdodiactins. Thus, in the Amphidiscophora the two families, above referred to, as being constantly uncinatophorous, the megascleres for the support of choanosome are as a rule hexactins or pentactins or both (Pheronematidae), or are else tauactins (Monorhaphididae), but apparently never rhabdo-

diactins [1]), as many or all of them are in the Hyalonematidae which is generally without the uncinate. Again, in the Hexasterophora uncinatophorous forms occur, as already indicated, only among the Hexactinosa, which, representing as they do a part of ZITTEL's Dictyonina, have choanosomal supporting megascleres all hexactine and fixed, as it were, in that primary form, owing to their early fusion into the rigid dictyonal framework. In some Hexactinosa the uncinate seems to have disappeared; so likewise in the other dictyonine tribe Lychniscosa as well as in the lyssacine tribe Lyssacinosa, which, like the Hyalonematidae among the Amphidiscophora, is characterized by the choanosomal supporting spicules including amongst them, and sometimes consisting even entirely of rhabdodiactins, secondarily derived from the hexactin as attested by the presence in them of the characteristic axial cross. Now, if it be justifiable, as I think it is in a general way, to regard the condition of the choanosomal skeleton just referred to, to be one of secondary derivation from that in which it consists of hexactine or pentactine elements or of both, the presence of the uncinate always or nearly always in association with the latter appears to lend support to the above expressed view that that spicule is an old one, dating back to an exceedingly ancient period of the Hexactinelliden phylogeny [2]).

1) Rhabdodiactin, a term proposed for designating diactins in which the two rays present, are in a line and thus give to the spicule the shape of a rhabd. It stands in distinction from the orthodiactin in which the two rays belong to two different axes of the triaxon and form an angle of 90° between them.

2) With regard to the status of the uncinate in the morphological classification of Hexactinellid spicules, I am in considerable doubt. On a former occasion (IJ., 1903, p. 25, foot-note) I have called attention to the fact that the uncinate can not be proved to be secondarily derived from a triaxon, since its axial canal nowhere shows the axial cross, which, in my view, should be present somewhere in the course of the canal if it be a triaxon derivative. True, among the smallest and finest uncinates with obsolete or nearly entirely suppressed barbation of some Tretodictyid species (f. i. *Hexactinella ventilabrum* Cart., *H. grimaldi* Tops., *H. lingua* n. sp., *Auloplax auricularis* F. E. Sch., *Cyrtaulon sigsbeei* [O. Schm.], *Tretocalyx polae* F. E. Sch, *T. monticularis* [V. Ldfld.]), occasional cases are known of the spicule exhibiting a small simple swelling of the axial canal and a corresponding annular tyle of the siliceous sheath, and that always at a position nearer its one end than the other. Such an uncinate may justifiably be regarded as a centrotyle and anisoactine. The inconstant occurrence of the swelling in even the same uncinate variety points to its secondary disappearance in all cases of uncinates in which it can not be discovered. If so, there seems to exist no obstacle in ascribing diactine nature to the entire class of uncinates, as indeed it has frequently been done by authors in an off-hand way. But then, in the complete absence of the axial cross in all cases, a full evidence for deriving the uncinates from a triaxon or the hexactin must be said to be still wanting. The uncinates, with the axial canal in the simple state indicated above, are in no way distinguishable from the monaxon in that respect.

It would however be necessary to give a turn to the above consideration, if it could be shown that the "uncinate amphiox" or "diactine uncinate", recently described by R. v. LENDENFELD (1915) from two nearly allied *Hyalonema* (*Onconema*) species (*H. obtusum* and *H. agassizi*) and which, but particularly the smaller ones of it, should usually show a slight central tyle containing an axial cross, is really an uncinate, strictly homologous to that, we meet with in the Pheronematidae, the Monorhaphididae and most Hexactinosa. While I am by no means prepared to deny the homology with strength, I can not, nevertheless, entirely refrain from entertaining the suspicion that the *Hyalonema* uncinate in question may possible be a spicular form genetically distinct from the ordinary uncinate, in fact that we may have here to do with a modification, closely uncinate-like probably by convergent adaptation, of the so-called ambuncinate found in many Hyalonematids (*Chalaronema*, *Compsocalyx*, certain *Hyalonema* [Subgenera *Euhyalonema*, *Pteronema*, *Coscinonema*]). The ambuncinate is plainly a triaxon rhabdodiactin with the patent mark (axial cross), as is apparently also the "uncinate amphiox" v. LENDENFELD's; it itself arose probably as a differentiation from the choanosomal supporting rhabdodiactin of the family. For the alleged uncinate of *Hyalonema agassizi* it was given by v. LENDENFELD, that it sometimes occurs in the form of a monactine tylostyle and that some of the lateral spines nearest the tail-end of the spicule are vertical or even retrovertedly inclined. These are both facts which are quite unusual for the ordinary uncinate, but tend to indicate an affinity of the spicule in question towards the ambuncinate. But what weighs with me most in suspecting its ambuncinate derivation, is the fact that, in *Hyalonema pellucidum* from the Sagami Sea, I have discovered some exceptional cases of the ambuncinate in which both the rays had the spines all bent or inclined in the same direction, much as in the uncinate, instead of their being bent as usual towards the spicular centre on both the rays. It does not seem to be too farfetched an assumption to regard those cases as indicative of the way of origin of the *Hyalonema* uncinate. On the other hand, the assumption of its genetical identity with the ordinary uncinate, presents some difficulty for ready acceptance. In the first place, it is simply impossible to conceive that the cross-marked axial canal of the *Hyalonema* uncinate arose by complication from the simple state of that canal seen in ordinary uncinates. In the second place, the contrary alternative, that the *Hyalonema* uncinate preserves the primitive state of axial canal, while the others represent a secondary condition of the spicule in which the axial cross, originally present, is entirely atrophied, does not quite harmonize with the view, set forth in the text, that Hyalonematids are a family apparently of a more advanced characterization, than the Pheronematidae, from which they may have sprung out as an off-shoot and which therefore may sooner be expected to show marks of primitiveness in its spicules than the Hyalonematicae.

Here I may be allowed to digress and offer a remark on the stauractin. MINCHIN (1905), on ontogenetic and palaeontological

1. Family PHERONEMATIDAE J. E. Gray, 1870, emend.

= SEMPERELLIDAE F. E. Sch. (1904, p. 181) partim + HYALONEMATIDAE F. E. Sch.. (ibid.) partim.

Amphidiscophora with uncinate; choanosomal supporting spicules either macrohexactins or macropentactins, or both; prostalia (marginal and pleural) in the form of the sceptre; basal fibres with anchor made up of two opposite teeth and more or less arc-like in shape, standing out in a loose group or in a distinct tuft or tufts, of which the parts within the sponge body do not form a compact axial columella.

The family thus characterized covers the genus *Semperella*, which, together with *Monorhaphis*, was made by F. E. SCHULZE into his Semperellidae, as well as the four genera *Pheronema*, *Poliopogon*, *Platylistrum* and *Sericolophus*, all which were referred to by the same author to the Hyalonematidae.

The sponge body varies much in shape, from being like a thick-walled cup with the osculum opening above (*Pheronema*) to being somewhat like a thick spoon or a plate with the gastral surface widely exposed on one lateral side (*Platylistrum*, *Sericolophus*, *Poliopogon*), or to being elongate-columnar with exhalent orifices, either sieve-covered or freely open, distributed on all sides, but with certain regularity in relation to the intervening inhalent or dermal surface (*Semperella*).

The uncinate appears universally present in all the species of the Pheronematidae. It occurs in various sizes. So far as came under my observation, it is here, as in *Monorhaphis*, of the kind which is traversed right through by an axial canal but never exhibits the axial cross or what may be taken for the central swelling anywhere in its course. The barbs in the micruncinate may be very feebly developed; possibly they may be even entirely obliterated, for it seems not unlikely that the "small spindle-shaped smooth oxydiacts", mentioned and figured by F. E. SCHULZE (1887, p. 258) from *Poliopogon gigas*, is a barbless modification of the micruncinate.

The supporting spicules of the choanosome, apart from pentactine hypodermalia and hypogastralia, are as a rule either hexactins or pentactins, or else both together. Rarely they may be found in the form of the tetractin or the tauactin, but seem never to occur in that of the rhabdodiactin. However, as intermedial spicules which play, if at all, but a secondary rôle in the support of the choanosome, the rhabdodiactin (apart from the uncinate) may be

as well as on theoretical grounds, has advanced the opinion, that there is strong evidence for regarding the stauractin as an older type of Hexactinellid spicules, phylogenetically, than the hexactin and for deriving the hexactin primitively from the stauractin by the addition to the latter of two rays forming the third axis. So far as this bears in indicating the earlier origin of the stauractin than the hexactin, seems to me perfectly plausible and probably true; but the latter, in my view, need not necessarily be derived directly from the former. Be that as it may, it is an incontestable fact that many, perhaps all, of the stauractins ordinarily met with in adult Hexactinellids of the present day, are derivatives from the hexactin by numerical reduction of rays, as are so many other sorts of spicules with rays less than six in number. We are then driven to distinguish between two categories of stauractins, viz., the primary or archaic stauractin which had an origin independent of the hexactin, and the triaxon stauractin which arose secondarily from the hexactin.

Similarly it may be, I am inclined to think, that the rhabdodiactin should be distinguished into the archaic category which exhibits no tangible sign of derivation from the hexactin and the triaxon category of later and independent origin and belonging to the series of the hexactin and its derivatives. The former category is represented by the uncinate which originated in the Protohexactinellida and passed down into both the Amphidiscophora and the Hexasterophora, but the so-called uncinate of the Hyalonematidae possibly belongs to the latter category of rhabdodiactins, in which case that family, together with many Hexasterophoran families, appears to have entirely lost the archaic or true uncinate.

present in some Pheronematid species. For instance, HIGGIN (1875) has described from *Pheronema hemisphaericum*, besides certain other spicules which apparently represent choanosomal supporting spicules proper, some small "acerates" of $^1/_{10}$ inch average length — either smooth and with or without cruciately disposed knobs in the middle, or sparsely spiny, the spines being directed as in the ambuncinate of certain *Hyalonema* — the nature of which spicules as rhabdodiactins of triaxon derivation can not be doubted from the condition, figured by him, of their axial canal and the central axial cross.

Intermedial microholactins are of common, though not constant, occurrence in the choanosome. They are either hexactine or pentactine, with rays varying from spiny to simply rough.

Peculiar to the family are the prostalia, both marginal and pleural, which are in the form of monactins, called by F. E. SCHULZE (1904, p. 56) the "sceptre". This is known from all the genera and species, except *Poliopogon gigas* (though it is apparently present in *P. amadou* as marginalia). This may be due simply to the fact that the single specimen on which *P. gigas* was based, was a damaged one not improbably lacking from loss the parts bearing the prostals, as it factually seems to have lacked the marginal parts.

The sceptre (Pl. V, fig. 12) is a slender monactine needle which, on attaining a certain degree of development, projects itself radially out of the dermal surface. Smooth in its proximal parts, the distal attenuating parts are short-spiny, the spines being obliquely distally directed. It terminates at the outermost end with a small inverted-conical swelling which contains the axial cross and thus reveals itself to be the morphological centre of the monactine spicule. On the swelling stand lateral spines, either in a pair or in a circle of four, which differ but little in appearance from those of the shaft. Sometimes (as in *Semperella*) there exists on the terminal swelling, in addition to the simple lateral spines just mentioned, a central spine axially traversed by a prolongation of the axial canal of the shaft, from which fact it is clear that we have here to do with the last vestige of the atrophied distal ray. Plain prostal needles, found invariably broken off at the outer end so frequently met with in Pheronematids are, I believe, in all cases nothing else than old sceptres which have lost the distal spiny parts by damage. It is clear that prostals of the description must be held in distinction from those of the Hyalonematidae, in which the marginalia are pinular rhabdodiactins and the pleuralia (known in *Compsocalyx*) are rhabdodiactins likewise but entirely smooth on surface.

Some more important characterizations of the family are observed in connection with the basal anchoring spicules. In the first place, the terminal anchor at their inferior end, e. i., the morphological spicular centre of the monactine basalia, is always bidentate, and flat, the two opposite, well developed teeth together, in lateral view, presenting a shape somewhat arc-like or nearly semicircular and not unlike the flukes of a ship's anchor. The anchor is thus markedly different in appearance from that of all the Hyalonematids from which it has been described and in which it consists of a knob-libe swelling provided with a circle of several (usually 4—8) short and stumpy teeth. In the second place, the basal fibres, numerously present, spring out from the body sometimes in a loose group or a broad brush-like row, but more commonly grouped into a distinct tuft or a number of separate tufts. The tufts are not spirally twisted, nor do their parts, imbedded in the body, form the compact axial columella that we find in the Hyalonematidae generally. Its absence stands in relation with that of the

central gastral cone formed mainly by the apical end of columella and to be seen in many Hyalonematids.

Finally, the absence of the acanthophore seems to constitute still another noteworthy feature of the Pheronematidae as against the Hyalonematidae.

Differential key to the genera.

A. Body with a well-defined depression which is distinctly the gastral cavity.
  a^1. Gastral cavity opening above, so that the body is more or less like a thick-walled cup or bowl. Basalia generally in several separate tufts . . . . . **Pheronema** Leidy, 1868.
  b^1. Gastral cavity widely open on one side of body.
    a^2. Body shaped like a thick spoon, with thick oscular margin not flexed backwards. Basalia in a loose group . . . . . **Platylistrum** F. E. Sch., 1904.
    b^2. Body somewhat as above, but with thinning oscular margin sharply flexed backwards so as to cover a part of dermal surface. Basalia in a compact tuft . . . . . **Sericolophus** Ij., 1901.

B. Body without gastral depression.
  c^1. Body like a semi-involute plate, the concave side of which represents the gastral surface. Basalia in a broad brush-like row on the inferior body edge. . . . . **Poliopogon** W. Thoms.[1]), 1877
  d^1. Body of an elongate columnar shape, with exhalent or oscular areas, either sieve-covered or opening through relatively large orifices found isolated or in groups, distributed on all sides of the body and separated from one another by inhalent or dermal tracts. Basalia in several tufts but joined into a matted mass. . . . **Semperella** J. E. Gray, 1868.

In the "Siboga" collection are represented all the genera except *Platylistrum* and *Poliopogon*.

Genus **Pheronema** Leidy, 1868.

Pheronematid shaped like a thick-walled cup or bowl, with deep or flatly shallow gastral cavity opening above. Oscular edge sharply defined, usually furnished with marginal prostals. Pleural prostals standing out singly or in tufts. Basalia long, thread-like and flexuous, arising sometimes singly but more generally in separate tufts.

The *Pheronema* material contained in the "Siboga" collection is referable to *Ph. giganteum* F. E. Sch. and to two new species which will be called *Ph. weberi* and *Ph. echinatum*. This

1) Of the two species, viz., *Poliopogon amadou* W. Thoms. and *P. gigas* F. E. Sch., which were made to stand in this genus by F. E. SCHULZE (1902, pp. 4—5), the latter in my opinion had better be dissolved from generic association with the former and placed either in *Pheronema* or made into a distinct genus. The genus *Poliopogon* is here presented as consisting of the single species *P. amadou*.

brings up the number of surely known *Pheronema* species to nine. (For a key to all the species hitherto known, see F. E. SCHULZE 1904, p. 152).

1. *Pheronema giganteum* F. E. Schulze, 1886[1]). Plate V, figs. 1—7.

F. E. SCHULZE, 1887, Chall. Rep., p. 250; pls. XLV, XLVI.
—— 1893, Rev. Syst. Hyal., p. 563.

Stat. 251. 5° 28′.4 S., 132° 0′.2 E. 204 m. 1 specimen.

Diagnosis. — *Pheronema* with body ovoid or bee-hive-like in shape and attaining a large size. Gastral cavity pit-like and deep. Osculum fringed with marginal prostals; lateral surface with pleural prostals growing out in numerous tufts. These pass over below, without sharp demarkation, into the tufts of long basal fibres which form a matted lock. Anchor of basal fibres arc-like or Gothic-arch-like in shape, measuring up to about 500 μ between ends of teeth. Sceptre with 4 spines in a whorl on the terminal swelling. Dermalia with bushy oblong-ovoid pinular ray. Gastralia with pinular ray of a fir-tree-like appearance. Supporting megascleres of choanosome are smooth oxypentactins of varying dimensions, often irregular in shape. Intermedial oxyhexactins, with tubercled or more commonly vertical-spiny rays, present in abundance. Macramphidisc may be 250 μ long; the umbel consisting of 8 broad teeth, hemispherical and $^1/_4$—$^1/_3$ as deep as the entire length of the spicule; the shaft sparsely provided with rounded tubercles. Mesamphidisc present or absent. Micramphidisc of the usual appearance numerous. Uncinates present in two or more varieties, differing in dimensions and in the development of barbs, which in the smallest variety are so sparse and minute that the spicule may appear nearly smooth.

Description. — A moderately well preserved specimen referable to this species was trawled up by the "Siboga" at her Station 251, S. of Kur I. among the Kei Islands and not far distant from the spot where was obtained the first specimen of the species, described by F. E. SCHULZE in the Challenger Report (Chall. Stat. 192, 5° 49′ 16″ S., 132° 14′ 15″ E; depth 230—250 m.).

The "Siboga" specimen (pl. V, fig. 1) agrees well in general appearance with the figure given by F. E. SCHULZE of the type. The ovoid or bee-hive-like body is 112 mm. high and about as much in greatest transverse diametre. The somewhat narrowed upper end shows a roundish sharp-edged osculum of about 16 mm. diametre, while the broader and somewhat flattened basal end bears long hair-like basalia, which, arising from the body in numerous separate tufts, soon form a large matted mass of glassy fibres with inclusions of Foraminiferan mud. A long fibre extricated from the mass measured 340 mm. in length and 175 μ thickness in the thickest parts. The basal tufts may at times be 6 mm., and at other times only about 2 mm. broad near their origin. All over the lateral surface of the sponge there also exist numerous tufts of hairlike, bent or nearly straight fibres, which may project to a length of

1) The specimen, which was obtained at Stat. 122 and illustrated in Professor MAX WEBER's "Introduction et Description de l'Expédition", p. 105, may be referable to the present species. Its body is of large size and cup-shaped, being broadly rounded at base and somewhat narrowed above. According to Professor WEBER's note, the osculum at the upper end measures about 120 mm. in diametre. Height of body 275 mm.; its greatest transverse diametre 252 mm. In the basal parts of the sponge are found the long-hair-like basalia which arise in numerous separate tufts, having a length of about 300 mm.

60 mm. or more, but are almost always broken off at the outer end. These pleural tufts occur at rather irregular intervals of 5—15 mm. The stronger of them may consist of some sixty or more fibres, while a weak one may contain only about a score of these. The origin of pleural tufts is in most cases marked by a slight elevation of the sponge surface. As was noticed by F. E. SCHULZE (1893, p. 563), there can be drawn no essential distinction between the pleural and basal tufts in their general appearance, the only difference in that respect lying in the fact that, while the former have become early broken off so as to leave only the proximal parts, the latter generally persist in their full or nearly full length.

The sharp-edged oscular margin is entirely devoid of fringing marginalia, though these are known to have existed in a well developed state in the "Challenger" specimen. Their absence may be due simply to loss from some cause.

The external surface of the sponge is moderately even and uniformly granular-looking, owing to the very close presence of dermal spicules. Where these have fallen off, there comes into view the firm and closemeshed hypodermal framework that constitutes the fundament of the unusually thick dermal layer. The fibrous beams of the framework are of various strength, generally about half a millimetre and sometimes nearly 1 mm. or over in thickness. The mesh-spaces inclosed by the beams are small, generally measuring not more than 1 mm. across, and sometimes are so small as to be almost pore-like. They are usually of a somewhat irregular outline. The meshes are not always freely open, but are frequently spanned across by some intersecting rays belonging to certain superficial hypodermal spicules. In the uninjured state of the sponge surface, the dermal membrane, closely beset with dermal pinules, covers over the hypodermal beams as well as the mesh-spaces, and thus gives to the external surface the uniformly granular appearance before alluded to. The hypodermal mesh-spaces should not be mistaken for ostia or the entrances into incurrent canals of the choanosome. The ostia, beside being very much wider, lie deeper in the sponge wall and separated from the hypodermal layer by the wide subdermal space.

The osculum leads into a pit-like gastral cavity 62 mm. deep. The sponge wall is therefore very thick, measuring 40—45 mm. in thickness horizontally at the level of the bottom of gastral cavity, and about 53 mm. vertically between that bottom and the basal surface of the sponge.

The gastral surface, for a short distance from the osculum, is in part compact-looking and evenly granular, and in part of a more or less felt-like appearance. About the same condition continues to exist farther down the gastral cavity, except that here occur a number of irregularly distributed apertures of a roundish or oval shape and about 1 mm. or over in width. These apertures are either freely open or partially covered over by the thin gastral membrane supported by some singly running spicular rays (somewhat as represented in the Chall. Rep., pl. XLVI, figs. 10, 11). They are not, strictly speaking, the "exit openings of the efferent canals" (ibid., p. 251) or the postica, but are gaps in the thick gastral skeletal layer, or to be more exact, mesh-spaces bounded by strongly developed hypogastral beams. In fact, the gastral skeletal layer is of much the same structural character as the dermal.

On sectional surface of the sponge wall one sees the canals, both incurrent and excurrent, in essentially the same arrangement as was given by F. E. SCHULZE in the Challenger Report. Some of them reach a diametre of 5 or 6 mm. Conspicuous in the sections are numerous,

radially disposed, compact sheaves of silky threads (macruncinates), the outer end of which lies just at the dermal surface or projects a short distance beyond it. The sheaves, which at places may be about 0.75 mm. thick, extend internally into the choanosome to a depth of 30 mm. or more. Most of them occur in combination with the roots of prostal tufts, both pleural and basal.

The wall surface of both incurrent and excurrent canals appears to the unaided eye to be composed simply of intersecting fibres, showing at intervals large and small niche-like depressions or entrances into smaller branch canals.

Spiculation. Dermal pinules (pl. V, fig. 2) pentactine with basal rays about 70 μ long and 2 μ thick at base, tapering to a point and showing a few spinules in the distal half of their length. The pinular ray, consisting of a swollen rachis and closely set spines, is bushy, oblong-ovoid, generally 85—95 μ high and 40—50 μ broad in the broadest part; a few number of basally situated spines are nearly erect or at any rate much less obliquely outstanding than those in the upper parts; the central cone is thin and inconspicuous. The dermal pinules are moderately uniform in appearance and dimensions all over the sponge surface.

Gastral pinules (pl. V, figs. 3, 4) differ from the dermal chiefly in the pinular ray being more elongate and of a spindle-like shape. Length of that ray generally 180—250 μ, its greatest breadth 50—60 μ. Exceptionally it is so slender as to be 35 μ broad by 230 μ long, or so weakly developed as to measure 30 μ by 120 μ or even smaller. Usually the greatly thickened rachis ends at the apex with a conical point. A few spines at base of the bushy parts are short and conical, and often stand out erect, or even bent or directed away from the apical end. Not infrequently the pinular ray is found gently curved near the free end, as if by pressure of a current.

Canalar pinules, found alike in both incurrent and excurrent canals, are slim-rayed pentactins and sometimes hexactins, which latter seem to gradate over into the more slender-rayed of the choanosomal intermedial oxyhexactins with spinose rays (pl. V, fig. 7). The pinules in question occur in irregular distribution, being found very sparsely in some parts but rather numerously, though never crowdedly, together in some other parts. In length of rays they vary from 50 μ to over 100 μ in different spicules, by a thickness of 2 μ or less at base. The cruciately disposed basal rays show a sparse number of microtubercles or spinules. The free or pinular ray is distinguished by being longer, and further by having longer and more numerous spines, which, in their arrangement somewhat like those of the leaves on a grass stalk (fig. 7*a*). When the sixth ray opposite the free ray is present, as it occasionally happens to be, that ray is of the same characterization as the cruciate basal rays; or it may be proportionally very short and smooth, representing a stage in the transition of the hexactine form into the pentactine.

As regards the pinules generally, some not inconsiderable differences may be pointed out as existing between the "Siboga" specimen and the type as described by F. E. Schulze. In the latter that author found the pinular ray to be in general much shorter in gastralia than in dermalia; whereas, the opposite is the case in the former as indicated above. Another noteworthy point of difference lies in the fact that in the "Siboga" specimen I have never met, in either the dermal or the gastral layer, with such large pinules as have the pinular ray elongated to a length of 500 μ (F. E. Sch. 1887, pl. XLV, fig. 2; 1893, p. 563). Nor have I ever come, on the wall of excurrent canals, across such a tall and relatively slender pinule as stand

figured in the Challenger Report, pl. XLVI, fig. 6 and is said to attain a length of 400 μ or more (l. c., p. 253).

Pleural prostals in tufts are thread-like, usually smooth all over, proximally gradually drawn out to a point and distally terminating with a broken end. They may be 165 μ thick in the thickest parts. Nowhere in the course of their axial canal can the central cross be brought into observation. It seems not unlikely that we have here to deal in part — sometimes very largely or perhaps even entirely, especially as regards the needles of the more inferiorly situated pleural tufts — with the remnants, left behind after the breaking of the distal parts, of monactine spicules identical with the anchorate fibres of basal tufts. At the same time it also seems certain that, for the rest, the pleural prostals are sceptres. This goes forth from following observations. Among the finer, and therefore assumably the younger, pleural prostals 60 μ or under in thickness, there are occasionally found such as show some number of small spines near the outer broken off end. The spines stand out, not obliquely inwardly directed like those on anchorate basals, but directed in the opposite direction as they should be if the needles were the sceptre. After a prolonged search in the pleural tufts, I have succeeded in discovering a case of a small prostal needle, completely preserved in all its parts. This proved to be in fact a sceptre of essentially the same characterization as that known from other *Pheronema* species, — smooth in the proximal parts, but spiny in the above indicated manner in the distal parts, and with the extreme distal end (i. e. the morphological spicular end containing the axial cross) somewhat swollen and provided with four lateral spines in a whorl. Such a sceptre, if left to continue its growth, may easily be imagined to grow in dimensions, principally in the smooth proximal parts lying in the sponge body, and after the breaking off of the freely projecting distal parts, to change into such fibres as actually make up the pleural prostal tufts. F. E. Schulze (1887, p. 253) too seems to have found sceptres among pleural as well as marginal prostals of the type specimen. I should think that the sceptre constitutes par excellence the prostalia of the upper parts of body, and that the marginalia probably consist exclusively of it, except for the possible presence of macruncinates intermingled in the fringe.

The fibre-like basalia (pl. V, fig. 6) are provided at their extreme distal end with a flat bidentate anchor, which is known to contain the axial cross and thus represents the morphological centre of the monactine spicule. The anchor, seen flat side on, presents a Gothic-arch-like outline on the convex inferior side, the curvature being much more strongly pronounced than in the figure given by F. E. Schulze of the same structure from the type-specimen. Distance between tips of both teeth, i. e., the total breadth of the anchor, measures 250 μ; vertical distance between the line connecting the tips and the anchor apex, 190—220 μ. According to F. E. Schulze, the anchor in the type specimen had a breadth of about 0.5 mm. The shaft of basalia begins from the anchor with a thickness of about 50 μ. About 800 μ above that point, it is not thicker than 22 μ. Thence proximad it again gradually increases in thickness, at the same time showing a spiral series of obliquely proximally directed spines. The spines, after existing in a well developed state for a stretch of 20 mm. or thereabout on the shaft, begin to be rudimentary; the intervals between them grow increasingly wider, and after a time they cease to exist altogether, in which parts the shaft may have acquired a thickness of about 60 μ. For the rest of its length, the shaft is smooth, which part in greatly elongated basalia may reach the maximum

thickness of 175 μ. The spiny character of the basalia near their distal end is remarkable, since F. E. SCHULZE seems to have found the shaft smooth throughout in the type specimen, as is in fact the case in a specimen of the same species known to me from the Japanese coast. However, the difference may not be of much systematic importance. In a yet undescribed *Pheronema* species (*Ph. pepo* Ij. MS.) I have found both kinds of basalia occurring together in the same individual.

The strongly developed hypodermal framework is made up of the paired rays of macroxy-pentactins with the unpaired ray dipping inwards. A large proportion of these hypodermal pentactins differ in no way from the choanosomal pentactin to be described further on. Others amongst them may be said to be peculiarly hypodermal in that they are specially strongly and more or less regularly developed. In these the regularly cruciate paratangentials are nearly equally long in the same spicule, measuring 3—8 mm. in length and reaching 600 μ or more in thickness at base. The unpaired proximal ray is about as long as, more commonly much longer and occasionally shorter than, the paratangential in the same spicule; it may reach up to a length of 14 mm. The above stout pentactins can without difficulty be detected with the naked eye on the sponge surface where the dermal layer has fallen off, and can be readily picked off from the rest by means of a pincette.

Hypogastral beams are spiculed in the same way as the hypodermal, excepting the fact that there occur no specially stoutly developed pentactins corresponding to those found in the latter.

The supporting megascleres of the choanosome are oxypentactins of various sizes and with relatively slender rays, smooth all over. The rays of one and the same spicule are frequently unequally long, and sometimes very markedly so. They stand not always at right angles to one another. While a small one of the spicules may have rays, only 1 mm. long and 20 μ thick at base, a large one may have them measuring 10 mm. and 100 μ in respective dimensions.

As intermedial microhexactins of the choanosome may be described the small but variously sized and more or less regularly developed oxyhexactins with microtubercled or spiny rays (pl. V, fig. 7, *a*, *b*, *c*). These occur in great abundance in all parts. In the larger examples of them the rays are moderately strong, measuring generally 500—300 μ long and about 10 μ thick at base. These are nearly straight, gradually tapering, and ordinarily sparsely and insignificantly microtubercled on surface, the microtubercles being sometimes elongated into nearly vertically standing spines. In the smaller examples of the spicule, ranging from those with rays about 300 μ long down to such very small ones as have rays under 100 μ length and only 2 μ or even less thickness, the armature of rays is generally distinctly spine-like. Moreover, the rays may sometimes be slightly bent and unequally long. The slim-rayed spiny oxyhexactins in question seem to intergrade with the pentactine canalar pinule, as already mentioned. At some places, but evidently in the trabecular zone around canalar lumen, I have found spiny slim-rayed oxyhexactins and oxypentactins of varying sizes numerously together. From the type specimen F. E. SCHULZE (1893) has given the same spicule as microhexactins of 100—200 μ diametre, with strong and spiny rays.

Of the macramphidisc only a few examples were met with near the dermal surface. In one case it was 264 μ long; the axial shaft 16 μ thick, sparsely studded with rounded tubercles; the umbel hemispherical, 100 μ broad and 65 μ deep, consisting of eight, rather broad teeth

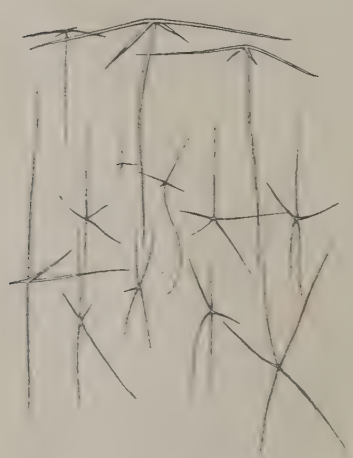
(pl. V, fig. 5). Another example found was smaller, measuring 170 μ long; with umbel perceptibly truncate at apex, 65 μ broad and 55 μ deep. — Mesamphidisc was not discovered in spite of searches made after it. In the type specimen F. E. SCHULZE has found both macramphidisc and mesamphidisc in greater or less abundance in certain parts. — Micramphidisc of the usual appearance is exceedingly numerous in all parts of the choanosome as well as in dermal and gastral layers. Its length is 20—26 μ, with umbel about 8 μ broad as well as deep and made up of 12 teeth.

The uncinates in the "Siboga" specimen may be mentioned under four categories, as follows. Firstly, those of a very large size found very numerously and arranged in radial sheaves, with their outer end at, or close to, the dermal surface. They may be called the dermal macruncinate. Length about 20 mm., greatest thickness nearly 35 μ; barbs longer than in W. THOMSON's figure given in the Challenger Report (pl. XLV, fig. 10). Secondly those of a much smaller size, also numerously present, forming indefinite sheaf-like groups which stand with the inner end disposed vertically against the gastral surface. They may be referred to as the gastral macruncinate. Length 2 mm. or under, with greatest thickness of about 7.5 μ; barbs much more feebly developed in the dermal macruncinate. Thirdly, those of a small size — generally 800—550 μ long and 15—10 μ thick — found here and there in scattered distribution in the choanosome, but often placed more or less vertically to the canalar wall. They may be called the canalar micruncinate. Compared with either of the foregoing categories, the shaft is less thinly drawn out a both ends, and the relatively short barbs are somewhat more strongly outstanding. Apparently these micruncinates are identical wich those figured in the Challenger Report, pl. XLV, fig. 6. Fourthly and finally, those of smallest size — generally under 125 μ length and sometimes even as short as 75 μ, with thickness of 4 μ or less — found moderately abundant in irregularly scattered distribution in the choanosome. A fit appellation for them will be the choanosomal micruncinate. They are minutely and rather sparsely barbed. Probably this and the last mentioned category of uncinates pass into each other gradationally by intermediate forms.

Appendix. — ? *Pheronema giganteum* F. E. Sch (Stat. 286. 8° 50′.2 S., 127° 2′.2 E. 883 m.). From Stat. 286, a spot off the south coast of eastern Timor, comes the dead and completely macerated fragment which is here referred to *Ph. giganteum* with some degree of uncertainty. As at first examined, it was covered and internally filled up with a sticky clayey mud in which were mixed numerous Foraminiferan shells. On cleansing, the fragment showed itself to be an irregularly hemi-ovoid mass, 86 mm. long, 66 mm. broad and 50 mm. thick, probably representing a large segment — severed off, without including in it the osculum and the gastral cavity — of a very thick-walled sponge, which may well have been of the general body shape known of *Ph. giganteum*. The strongly convex side of the fragment presents a moderately even surface, which is undoubtedly the external; and the spicular layer covering that surface, is in all probability the hypodermal framework completely denuded of the dermal layer. To the unaided eye that framework appears to be made up of intersecting fibres running in all directions, thus bringing about an irregular closemeshed reticulation. At places beneath it there is discernible the presence of wide subdermal spaces. The other side of the specimen

is largely the torn off surface and exposes to view a number of open canals, varying from 3 mm. to 12 mm. in width. These, separated as they are from one another by skeletal septa of varying thickness and of an appearance like a coarse fabric, give to the skleton quite a cavernous structure. A little scrutiny suffices to distinguish the canals into the incurrent and and the excurrent, the former being those which are in direct communication with the subdermal space, while the latter are not. It is easy to conceive that a skeleton of much the same general structure as the present one would be produced by maceration of the specimens known to me of what may justifiably be identified with *Ph. giganteum*. Only the present piece of skeleton occurs to be quite unusually firm. It is in fact almost rigid, notwithstanding that, there exists no synapticular fusion of the constituent spicules. The firmness is due solely to the tight and intricate interlacing of prolonged spicular rays, a fact which made it no easy matter to extricate single spicules without injury to their parts or disturbing the texture of adjoining parts.

The choanosomal megascleres are all smooth and slender-rayed oxypentactins of various sizes. Several of them are shown in the accompanying textfigure. The majority of them are moderately large, attaining much larger dimensions than in the above described specimen of *Ph. giganteum* from Stat. 251. In a very large example of the spicules the longest ray may be 20 mm. or thereabout in length and 275 μ in thickness at base, tapering to 38 μ. near tip. Whereas, a small example may have rays of only 1—4 mm. length and about 45 μ thickness at base. The spicules in question are but seldom orthopentactins with rays of approximately same length. The rule is that they are of a more or less irregular shape, the five rays being unequally long and that often to a very marked degree, the longer rays more or less bent, and the angles any two of the rays make at their base, very frequently either greater or less than 90°. In several cases the unpaired ray was found so sharply bent, soon after its origin, that it came to lie nearly in one uneven plane together with the paired rays. The varying development and irregularities of the rays are obviously in relation to the limited width of choanosomal septa and to the curvature of same.



Textfig. 1. — Three hypodermal and several choanosomal, oxypentactine megascleres, taken from ? *Pheronema giganteum* obtained at Stat. 286. × 2.

The hypodermalia (textfig. 1) that make up the external covering layer are likewise all oxypentactins, but which in shape more nearly approach the orthopentactin and are frequently more strongly developed than the choanosomal pentactins. They consist each of a paratangential cross, the plane of which is slightly convex on the outer side, and of a proximally directed unpaired ray, all the five rays being straight or nearly straight. The size varies within a wide range. While a small example of the spicule may measure only 4 or 5 mm. in length of paratangential axis and 90 μ in thickness of rays at base, the larger ones may be 20 mm. and nearly 400 μ in the respective measurements. The four paratangentials in the same spicule are as often as not of unequal lengths. The unpaired proximal ray is usually longer — often more than twice longer — than the longest paratangential of the same spicule. In certain cases the proximal ray is on the contrary very much shorter than any of the paratangentials, then probably ending free in

the subdermal space without participating in the formation of connecting pillars between the dermatosome and the choanosome.

Seen on the external surface of the specimen under the hand-lens, the paratangential crosses of hypodermalia lie without any definite rule as to their disposition in relation to one another; so that rays, belonging to different crosses, repeatedly intersect one another at varying angles, running singly and without forming bundled beams. Unless they be of a very small size, the several crosses lie not regularly superposed one above another, but with the rays interwoven, somewhat after the manner of fibres in a fabric. — No other kind of spicules than those described above could be discovered in the specimen.

2. *Pheronema weberi* n. sp. Pl. IV, figs. 10—12; pl. V, figs. 14—21.

Stat. 253. 5° 48′.2 S., 132° 13′ E. 304 m. Several specimens.
Stat. 256. 5° 26′.6 S., 132° 32′.5 E. 397 m. Fragments.

Diagnosis. — *Pheronema* with body of an irregular, thick-walled, more or less laterally compressed, bowl-like shape. Dermal and gastral surfaces similar in structural appearance. Oscular margin with an interrupted row of fine marginalia. Basalia in long slender tufts scattered over basal and infero-lateral parts of body; with small anchors of a Gothic-arch-like shape, measuring 100—125 μ between ends of teeth. Dermalia with fusiform and fir-tree-like, or somewhat more bushy, pinular ray of 57—70 μ length. Gastralia like the more slender dermalia, but longer; with finely drawn out rhachis, projecting at the free end. Supporting megascleres of choanosome pentactine, often irregular in shape. Intermedial microholactin commonly pentactine and rarely hexactine, with nearly smooth rays. Macramphidisc 220—213 μ long, with hemispherical or semi-ovoid umbels of $^1/_4$ the entire length and with shaft tuberculated in the middle parts. Micramphidisc sparse, 28—23 μ long. Macruncinate with slender barbs flatly appressed to shaft, present on both dermal and gastral sides in vertical disposition to surface. Choanosomal micruncinate rather robust, nearly equally tapering toward both ends, with short and obliquely outwardly projecting barbs. Much thinner micruncinate present in both dermatosome and gastrosome.

Description. — Of this new species of *Pheronema*, a number of more or less injured specimens came up in the trawl at Stat. 253, near Taam Island, one of the Kei Islands. Out of this lot of specimens I have selected for description the three best preserved ones, which in the following will be designated specimens A, B and C.

Specimen A (pl. IV, fig. 10) is a moderately large individual shaped somewhat like a thick-walled through or a laterally compressed bowl of an irregular configuration. In spite of not inconsiderable damages which the wall had sustained in parts, it may be judged that the horizontally elongate body may well have been about 80 mm. long in the original intact state. As the specimen now remains, the length is 67 mm., the width across the osculum 34 mm., and the height of body 31 mm. The gastral cavity is a widely open groove-like concavity, angulated at the bottom in line with the length of body. Oscular margin gently wavy, rather thick, but showing a continuous and distinctly angular edge-line. Thickness of body-wall midway on the sides about 10 mm.; same between bottom of gastral cavity and basal surface about 15 mm.

Specimen B (pl. IV, fig. 11) is a fragment, probably representing one end of an individual

similar in shape to, but smaller than, the specimen just described. Width of osculum 16 mm.; gastral cavity only about 6 mm. deep in the deepest parts; thickness of wall at base about 10 mm.

Specimen C (pl. IV, fig. 12) is nearly complete. The body is somewhat like an irregular, thick-walled but sharply margined, laterally compressed funnel. The upper end, i. e., the wide oscular opening, measures 36 mm. by 22 mm.; height of body 28 mm. The gastral cavity is only about 8 mm. deep; it is a widely open concavity, laterally compressed in relation to the general shape of body.

In both the specimens A and B there exists a thin and much interrupted row of fine but conspicuous marginalia, standing right on the marginal edge and projecting out to a varying length up to about 7 mm. In specimen C the marginalia are represented by some inconspicuous needles that stand out isolated here and there on or along the marginal edge on the outer surface of wall. In all the specimens there arise a number of separate basal tufts, composed of fine filaments, from the basal parts and sometimes also from parts well up the lateral sides of the sponge, not crowded together, but usually a moderate distance apart from one another. The dermal surface at the points of their origin may be elevated, sometimes very slightly but sometimes distinctly into conuli. The tufts themselves may be several cm. long, but are never of a great thickness. A slender tuft may consist of only a few fibres; and even the strongest tufts, usually met with in the lowest parts of body, are seldom, if ever, more than 1 mm. thick at their origin.

The dermal and gastral surfaces are generally quite alike in the macroscopic appearance of their structure. If any difference can at all be observed between them in that respect, it consists in the more frequent occurrence in the former of macruncinates that protrude their outer end externally. Generally both the surfaces are covered over by a continuous dense-looking layer of pinules, dermal or gastral, as the case may be. Only at places where that layer has fallen off or is deficiently developed, is revealed the hypodermal or hypogastral latticework, formed of delicate beams inclosing open meshes of a rectangular or nearly rectangular shape. These meshes are always under 1 mm. in the length of sides. Besides, some specimens may show, on both the surfaces but especially the dermal one, a varying number of round, smooth-edged and perfectly natural-looking orifices, about 1 mm. or more, in diametre. These, I hold to be holes that originated in relation to the presence of certain commensal animals in the sponge parenchyma. The internal canals of the sponge, which can be vaguely discerned by holding the specimens against the light, seldom exceed 3 mm. in width. The texture of the body is about the same as that of ordinary *Hyalonema*.

From Stat. 256, also in the neighbourhood of Kei Islands, there are some small fragments of the species, entangled among a matted mass of rooting fibres. They are probably parts of a single individual. The spiculation is essentially the same as that of specimens from the other station. The fragments are thickly impregnated with Foraminiferan and Radiolarian remains.

Spiculation. — The following description of spiculation refers in the first instance to that in specimen A.

The small pentactine dermalia (pl. V, figs. 14, 15), closely besetting the external surface, have the pinular ray generally 57—65 μ (rarely up to 70 μ) long and the basal cross made up of rays 53—60 μ long. The rhachis of pinular ray is about 5 μ thick in the basal spineless

parts; it slightly thickens in the spiniferous parts, to terminate above with a finely drawn out and freely projecting apex. The spines differ considerably in the degree of their development in different pinules. Thus, in some of the pinules the entire pinular ray is spindle-shaped and fir-tree-like, measuring 16—23 μ across in the broadest part which is in the middle of its length. In other cases the ray is of a more bushy appearance, owing to longer development of the lateral spines; it then reaches 30—34 μ in greatest breadth, narrowing above conically to the sharply pointed apex of the rhachis, which now projects less prominently than before. Basal cross regular, flat; the rays sparsely microtubercled and gradually tapering outwards. The crosses combine to form a dermal latticework, regularly quadrate-meshed at some places and more irregular at others.

Gastral pinules (pl. V, fig. 16) are like the more slender-shaped examples of the dermalia, though on the whole somewhat longer. Thus, the pinular ray may measure 72—90 μ, sometimes even 100 μ, in length; it is fusiform and 15—23 μ in greatest breadth. The apical end of rhachis is finely drawn out to a point and often projects to the extent of 20 μ beyond the end of last spines. The basal cross is nearly the same in dimensions as that of the dermalia.

Dermal and gastral layers are supported respectively by moderately large and smooth-rayed hypodermal and hypogastral oxypentactins in the usual way. These vary in size from those in which the rays measure 500 μ by 20 μ or thereabout, to others with rays about 1.6 mm. long and nearly 90 μ thick at base. In shape the pentactins are not uncommonly quite or nearly regular, though sometimes the rays in the same paratangential cross may be unequally long or are gently bent in the plane of the cross. The unpaired ray is generally somewhat longer than paratangentials of the same spicule; sometimes it does not stand quite vertical to the plane of the latter. The paratangential crosses form a hypodermal or hypogastral latticework, as the case may be, the meshes of which are generally approximately rectangular and may measure 0.4 mm. to nearly 1 mm. in the length of sides.

The supporting megascleres of the choanosome are oxypentactins of much the same dimensions as the hypodermalia and hypogastralia, but are frequently of a more pronounced irregular or asymmetrical development in having the rays markedly unequal in length, more or less bent in their course or making varying angles with one another at the spicular centre.

There is a not infrequent occurrence, in the choanosome as well as in both the dermatosome and gastrosome, of intermedial microholactins of the oxypentactine form. These are delicate spicules with straight rays which are generally nearly smooth throughout and measure 40—70 μ long and not more than 2 μ thick at base. Occasionally the micropentactin presents itself in a pinule-like form, as the unpaired ray, besides being somewhat elongated (up to 90 μ) over the other rays, bears a few numbers of short and obliquely outwardly directed spines. As a matter of exceedingly rare exception, the sixth ray may be developed, making it necessary to call the spicule a microxyhexactin. Probably some of the microscleres under treatment, but especially the pinule-like form of them, may be looked upon as the canalaria; but there seems to exist no sharp distinction between this and others of purely intermedial nature. Oxyhexactins with all the rays echinated, such as are known from many other *Pheronema* species, do not occur.

The marginalia are slender needles finely drawn out to a point at the inner end, but found invariably broken off at the outer. They may reach a length of 8 mm. and a thickness

of 30 μ. There can be but little doubt that we have here to do with the "sceptre", the monactine prostal needle, peculiar to the family. One is strengthened in this view by the fact that in many cases of the marginalia the parts, adjoining the outer broken off end, are found to be beset with tubercles, which, towards the extreme end, take the form of obliquely outwardly directed spines similar to those in the distal parts of the sceptre found in other species of the family.

The basalia are fine, long and flexuous fibres, not more than 42 μ thick in the thickest parts and thinning down to only about 15 μ near the inferior anchorated end. They are perfectly smooth except for a relatively short extent of about 10 mm. adjoining the anchor, in wich parts they are spiniferous in the usual way (pl. V, fig. 18). The bidentate anchor is small, measuring 100—125 μ in a line from end to end of the teeth and 65—87 μ from the middle of that line to the anchor apex. The anchor in lateral view shows the outer convex contour curved like a Gothic-arch, rounded at the top. The inner contours of both teeth are seen to run continuously into each other on either side of the origin of shaft, and thus to give to the anchor a continuous concave inner contour which shows a slight convexity in the middle.

Macramphidiscs of the following characterization occur rather sparsely, but by no means uncommonly, in both the dermatosome and the gastrosome (pl. V, fig. 17). Length generally 213—220 μ; umbel 54—57 μ long and 68—70 μ broad; shaft 12 μ thick. An exceptionally small macramphidisc measured 122 μ long and 38 μ in both length and breadth of umbel. The umbel is generally nearly hemispherical or somewhat semi-ovoid, consisting of eight moderately broad teeth, rounded or pointed at end. The shaft is tubercled in the middle parts, but smooth in the parts within the hollow of umbels. The tubercles in a whorl around the spicular centre are sometimes, but not always, distinguished over the others by a somewhat larger size.

In preparations of specimen B I have come across with some very large macramphidiscs of a character quite different from the above. Ultimately, however, I became convinced of their extrinsic origin, identifying them with the macramphidisc of *Hyalonema keiense*, fragments of which form were found in the same bottle with the present species.

The micramphidisc is found in sparse distribution in all parts of the body. Length 23—28 μ. Umbel nearly hemispherical, less than 7.5 μ long, composed of about 10 teeth. Shaft nearly smooth all over.

As in *Ph. raphanus* the mesamphidisc does not occur.

The uncinates fall under two categories, the macruncinate and the micruncinate, of which the latter may again be distinguished into two kinds.

The macruncinates lie so disposed in the sponge body that their outer end abuts on the external bounding surface, both dermal and gastral, or even projects a short distance out of that surface at varying angles. They occur more numerously on the dermal than on the gastral side of the wall, frequently arranged in sheaf-like groups of varying strength. Sometimes they are seen running in close company with proximal rays of hypodermal macropentactins. The macruncinate may measure 6 mm. long and 23 μ thick in the thickest parts, though many are much smaller. As in the corresponding uncinate of other *Pheronema* species, the thickest parts lie distinctly nearer the outer than the inner end. The latter is drawn out to a fine point. The barbs (pl. V, fig. 19), which are quite narrow, straight, except at base in profile view, and may be 27 μ long, lie flat over the underlying groove; and their extreme end appears to be quite

or nearly in contact with the shaft surface just behind that groove, instead of presenting a raised pricking point. So that, the spicule appears continuedly even-contoured, in spite of the presence of the barbs. This constitutes one of the remarkable features of the species.

Of the micruncinates, the kind which is restricted in distribution to the choanosome is short but rather robust looking (pl. V, figs. 20, 21). It may measure 575 μ in length and 15 μ in thickness, though a small one of the kind may be only 180 μ long and $7^1/_2$ μ thick. It is thickest in the middle, and the two ends are about equally pointed, without being finely thinned out. The barbs are small, less than 4 μ long, and distinctly so standing out as to be prickly. In some places of the choanosome this kind of uncinates occurs in abundance but without any definiteness as to the manner of their arrangement.

The second kind of micruncinates is found in moderate abundance in both the dermatosome and the gastrosome, again showing no rule as to the direction taken by their long axis. It is much finer than the choanosomal micruncinate, being not thicker than 5 μ by a length of 275–500 μ. It is equally finely attenuated towards both ends. The barbation is very weakly developed.

Remarks. — I consider this new species a good one. It is probably most nearly related to *Ph. raphanus* of the Indian Ocean. Indeed, in the matter of spiculation the two species may be said to be essentially indentical, save in certain points of detail. As the more important points of difference of this new species from *Ph. raphanus*, as known to be from the detailed descriptions given by F. E. Schulze, may be mentioned the following: 1. The laterally compressed bowl-like shape of body and the consequent groove-like appearance of the relatively deep gastral cavity. This constitutes a point of marked difference from *Ph. raphanus* in which the body is of an inverted pear-like shape and the gastral cavity a shallow circular depression at the broad end. 2. Origin of anchoring tufts not strictly confined to the basal parts of body, as it is in *Ph. raphanus*. 3. The weaker development of both marginalia and basalia. The former in *Ph. raphanus* are known to attain dimensions of over 20 mm. length by 0.5 mm. thickness, while the latter may be 40—80 μ thick with terminal anchor of 200 μ from end to end of the teeth. 4. Microxypentactins occurring in place of the microxyhexactins of *Ph. raphanus*. 5. The smaller size of macramphidiscs, which in *Ph. raphanus* may reach 300 μ in length. 6. The unusually depressed and flatly lying state of the barbs of macruncinates. 7. The more robust development of choanosomal micruncinates.

The species is decidedly distinct from *Ph. globosum* F. E. Sch., known also from the neighbourhood of Kei Islands, differing from it more especially in the characters of pinules and uncinates (cfr. F. E. Sch. 1887, pl. XLIV; and 1893, p. 25).

I take pleasure in naming the new species in honour of Professor Max Weber, the leader of the "Siboga" Expedition.

3. *Pheronema echinatum* n. sp. Pl. IV, fig. 9; pl. V, figs. 8—13.

Stat. 251. 5° 28′.4 S., 132° 0′.2 E. 204 m. 1 specimen.

Diagnosis. — *Pheronema* with small body of an ovoid shape; spiny, owing to presence of radiating pleural prostals. Osculum without a fringe of marginalia, leading into pit-like gastral cavity. Basalia arising either singly or in small groups from the basal parts; sparsely

and inconspicuously spinulated near the inferior end; with flat crescent-shaped anchor, 500 μ or more between ends of teeth. Pleural prostals or the sceptre with a pair of short spines at the free end. Dermalia small pentactine pinules with pinular ray, usually about 75 μ long, club-like in outline and not very numerously spiny, the tip of rhachis not forming a distinct terminal cone. Gastralia with pinular ray more elongate, up to 130 μ long and ending with free, finely pointed end of rhachis. Supporting megascleres of choanosome are oxypentactins and oxyhexactins of varying dimensions. Intermedial microholactin not found. Macramphidisc 286—330 μ long; with hyperbolic umbel, usually slightly flaring out at rim, about $^1/_3$ as long as the entire spicule; shaft with a fair number of small conical tubercles. Micramphidisc 60—34 μ long, with semi-ovoid umbel $^2/_5$—$^1/_3$ as long as the entire spicule. Uncinates in a single slender kind, up to about 4 mm. long and 12 μ thick in the thickest parts.

Description. — Together with *Ph. giganteum* and others, there was obtained at Stat. 251, South of Kur Island, among the Kei group, the single small specimen on which I have based this new species. The body is of an ovoid shape, being broadly rounded at base and somewhat narrowed above (pl. IV, fig. 9). The small osculum at the upper end is only about 1 mm. in diametre and leads into a narrow, pit-like gastral cavity. Height of body 12 mm.; its greatest transverse diametre 10 mm. A number of rather coarse, isolated and nearly straight pleural prostals radiate out of the body surface to a lenght of 10 mm. or less, giving to the sponge a pronounced spiny appearance. In the basal parts of the sponge, where the prostal needles are shorter and much less numerous than higher up in the body, are found the rooting basalia which are altogether not very profuse in number. These are fine, soft and flexuous filaments, originating from the sponge either singly or in small groups. Besides the stiff pleural prostals, the upper parts of the body show under the hand-lens numerous, very much finer needles — mostly uncinates and occasionally small sceptres — projecting out to a lenght of 1 mm. or less in a hair-like manner. A marginal fringe of spicules does not exist.

Spiculation. — The dermalia (pl. V, fig. 8) are small pentactine pinules, found in great profusion. The pinular ray with its lateral spines is of a club-like general shape. The ray is 60—84 μ — usually about 75 μ — high, and broadest at about the middle of its distal half, where it may measure 20—27 μ across. Its rhachis, about 5 μ thick at base, scarcely or only perceptibly thickens towards the tip. It remains spineless for a short distance from base. The spines, which are not very numerous, attain a maximum length of not over 18μ in the middle of the distal half of the ray. Of the two or three short distalmost spines it is usually difficult to determine which of them, or any one of them at all, represent the tip of rhachis. Rays of the basal cross, which is flat and regularly cruciate, are 57—76 μ long and about 4 μ thick at base, and taper gradually toward the finely pointed outer end. They are sparsely microtuberculated and appear nearly smooth, unless a high power of the microscope be used for observation. The dermalia are closely set together without the basal crosses forming regularly rectangular meshes.

The gastralia (pl. V, fig. 9) are pentactine pinules differing from the dermalia in having more elongate and more strongly developed rays, but especially in the shape of the pinular ray. This may reach 130 μ in length, and taken together with the spines, 23—34 μ in breadth in the middle parts, whence it narrows towards the free end. The strongly developed rhachis

terminates with a tapering, finely pointed and freely exposed tip. Rays of basal cross 110—120 μ long. The gastralia occur much more sparsely than the dermalia.

The long and coarse pleural prostalia, which were invariably found broken off at the outer end, may be 17 mm. long or longer and up to 230 μ thick in the thickest parts. Gradually tapering towards the inner end, they terminate there with a fine point. The surface of the externally exposed parts is densely studded with minute round tubercles, as is known of the similarly situated parts of old prostals in many other Hexactinellids. Having failed in all my efforts to discover the central cross in the course of the axial canal in such incomplete needles, I think it not amiss to regard them to be nothing else than excessively grown sceptres, from which spinulated distal parts, and therewith the spicular centre at the outermost end, were lost by breaking off. This view receives strength from following observations. In a few cases of the smaller prostalia of about 35 μ thickness, the parts near the outer broken off end were found to bear some obliquely distally directed spinules characteristic of the sceptre. Further, there were actually discovered, among the externally projecting macruncinates, some cases of small and obviously young sceptres, complete in all their parts (pl V, fig. 12). These fine sceptres, only 25 μ or thereabout in greatest thickness, were spinulated as usual in the attenuating distal parts, the spinules being obliquely distally directed, and terminated at the extreme end with a small swelling in which the axial cross was plainly demonstrable and which bore a pair of small lateral spines. There exists no trace of a distal ray opposite that which constitutes the shaft. Those small sceptres apparently owed their intact preservation to the protection afforded by their unexposed situation, but if left to grow to a prominent size, would in time most easily suffer damage in the outer parts and so may change into the condition of the strong incomplete prostals before described.

The basalia have a fine filament-like shaft which may grow to a length of nearly 20 mm. and a thickness of 30 μ in the thickest parts. Near the distal end it is furnished with some spines, but these are very small and low, besides being sparse in number and separated from one another by wide intervals (pl. V, fig. 13*a*). In some examples of the basalia the spines were so insignificant, both in size and number, that the shaft appeared smooth almost all over. The bidentate anchor is rather large, crescentic in shape, and quite flat. Its convex margin is uniformly arc-like, representing about one-fourth of a circle. Each tooth closely resembles the blade of a scythe in shape. Distance between ends of the teeth about 500 μ, sometimes 530 μ. Breadth of teeth at base, and also that of the shaft origin, about 65 μ. The shaft narrows to 15 μ thickness in less than 1 mm. distance from the anchor; its maximum thickness before given is reached much farther up. In sections of the sponge a number of apparently adolescent basalia were met with, still completely imbedded in the body, but with the anchor situated in the proximity of the dermal surface. In most of these the anchor seems to have already attained full development, although the shaft is yet short and very thin throughout. The earliest developmental stage I have come across, in which the anchor is yet in a rudimentary state, is shown in pl. V, fig. 13*b*.

The hypodermalia are relatively large oxypentactins, in which the paired paratangential rays are regularly disposed in a cross, but make an angle of slightly less than 90° with the unpaired, inwardly directed ray. The former are generally 0.7—1.3 mm. long and 50—80 μ

thick at base; the latter is usually somewhat longer than paratangentials in the same spicule. All the rays are quite smooth right up to the sharply pointed end. The hypodermalia occur numerously together, without forming a regular-meshed latticework with their paratangentials. Quite similar oxypentactins occur as hypogastralia in the gastrosome.

The supporting megascleres of the choanosome are oxypentactins and oxyhexactins of a varying size, with rays similar to those of hypodermalia and hypogastralia. A large choanosomal oxyhexactin measured nearly 4 mm. in axial length and 80 μ in thickness of rays, close to the central node. Frequently the rays are of unequal lengths in one and the same spicule. As a general rule, the megascleres under consideration are so disposed as to have one of their complete axes radially directed in the sponge wall.

Intermedial microholactins, known to occur in the parenchyme of other *Pheronema* species, were not discovered in the present species. Nor did any spicule, referable to the canalaria, came under observation.

Macramphidiscs (pl. V, fig. 10) are common subdermally, much less so subgastrally. They are generally 286—230 μ long. The umbel, made up of eight, rather narrow (not broader than 9.5 μ) and pointed teeth, is deeply bell-like. It measures 110—77 μ in breadth and 90—80 μ in length, being about one-third as long as the entire spicule. Always rounded at the bottom, it very slightly flares out at the rim in the larger macramphidiscs. In the smaller of same this flaring out of umbel rim is not always perceptible. The axial shaft shows a fair number of small and conical tubercles, of which those around the spicular centre differ in no way from the rest. Unusually small macramphidiscs of 180 μ, 150 μ or 120 μ length were but rarely met with. These exhibited much the same shape and proportion of parts as the larger ones, but always without the flaring out of umbels at the rim.

Micramphidiscs (pl. V, fig. 11) are fairly numerous in all parts of the body. They are relatively large, being much larger than in either *Ph. giganteum* or *Ph. weberi*, though showing a wide range of variation as regards their dimensions. Generally 53—34 μ long and 20—12 μ broad; umbel semi-ovoid, in length equal to $^2/_5$—$^1/_3$ that of the entire spicule, consisting of 15—10 narrow teeth; shaft with sparsely scattered micro-tubercles. The micamphidisc seldom reaches a size of 60 μ by 25 μ. It may be that a part, or perhaps the whole, of the spicules I have here called the micramphidisc, really corresponds to the mesamphidisc of other species.

Uncinates occur in abundance and, as it appears in a single slender kind, the macruncinate. They are mostly radially arranged in the body wall, with their outer end placed a short distance below the dermal surface, but sometimes projecting with that end externally through the dermal layer. Length up to 4 mm. or a little over; greatest thickness 12 μ. In general appearance and in the character of barbation, they agree closely with the dermal macruncinate of *Ph. giganteum*, though very considerably smaller in dimensions.

Remarks. — Judging from its small size, the single specimen on which I have based this species, is possibly an immature one, which, on further growth, may undergo some change of character in one respect or another. For instance, the spiny appearance of body, due to the long pleural prostals, may be simply a juvenile feature which in a later period of life might either disappear or grow relatively inconspicuous, as the prostals of the young of *Ph. raphanus* seem to do (F. E. Sch. 1900*a*). I have thought of the possibility of the specimen being only

a very young individual of *Ph. giganteum*, which species was obtained in the same haul of the trawl, but without being able to satisfactorily identify it with that species as with no other species known of the genus.

Genus **Sericolophus** Ijima, 1901.

The genotype and the only known species of this genus, *Sericolophus reflexus*, was first described by me under the name of *Hyalonema reflexum* (Ijima, 1894). Having, soon after, recognized its generic distinctness from *Hyalonema*, I have changed the name into *Sericolophus reflexus*, which name, however, has hitherto stood only incidentally mentioned in one of my later publications (1901, p. 128, foot-note). Now, *Sericolophus* is a genus which, as the spiculation shows, is so nearly related to *Pheronema* that it should decidedly be placed in association with that genus in the same family, but not under the Hyalonematidæ. This goes forth from consideration of the following points in the spiculation of *Sericolophus*.

1. The presence of genuine uncinates without axial cross, which are not known from any species of the Hyalonematidae but occur in all the genera I have put together under the Pheronematidae.

2. The choanosomal supporting spicules do not comprise rhabdodiactins of plainly triaxon derivation, as do those of the Hyalonematidae, but are exclusively hexactins and pentactins.

3. The presence of the sceptre, the monactine prostalia peculiar to the Pheronematidae.

4. The absence of the acanthophore, so generally occurring in the Hyalonematidae.

5. The basal rooting spicule has the anchor made up of two flukelike teeth, instead of being a knob with a circle of more than two short teeth.

6. The basal tuft, in the parts inbedded in the body, is divided into a number of strands, without forming with the upper end a compact axial columella and consequently without giving rise to a central gastral cone.

Of all the genera I have referred to the Pheronematidae (see the key on page 9), *Platylistrum*, with the single species *P. platessa* F. E. Sch., appears to be the nearest ally of *Sericolophus*, to which it shows a resemblance, above all, in the general external habitus of body. However, it differs from this notably in several points, as, f. i., in the unreflexed state of the much thicker oscular margin, in the presence of a continuous gastral lattice which covers over all the apertures of exhalent canals on the gastral surface, and in the much looser tuft of basal spicules. The peculiar monactin, crooked at the central end, which is known from among the basal anchoring needles of *Sericolophus*, has not been described from *Platylistrum*; and if it be really absent in that genus, the point should constitute an important difference between the two genera.

As regards the monactin just referred to, which I will call the crook for the sake of reference, I may here as well give some notes, based on my observations on Japanese specimens of *S. reflexus*. It is a fine, filamentlike spicule, smooth throughout, tapering to a point at one end, and terminating at the other end either simply rounded or with a slight knob-like swelling. The latter end contains the central cross of the axial canal, clearly showing the monactine nature of the spicule. The spicule is certainly not a diactin as given by F. E. Schulze in the

Valdivia Report (p. 180). It may be 10—20 mm. or more long and 7—10 μ thick for the greater part of its length. Characteristic is the fact that it is invariably bent in the terminal parts adjoining the rounded or knob-like end, somewhat in the manner of the shepherd's crook. The curvature usually exceeds a little over a semicircle, the diametre measuring about 60 μ on an average. For the rest of its length, the spicule is nearly straight, but may at places pursue a somewhat wavy course. The above crook occurs in a large number, along and together with much coarser shafts of ordinary anchorate basalia, but most numerously in the part of the basal tuft, close to the insertion of this into the sponge body. In situ, the crooked end, i. e. the end with the spicular centre, always takes the inferior or distal position, while the other end is proximally directed. The crooks and the anchorate basalia — both monactins, occurring in close association with each other and in identical orientation of their parts — are probably nearly related spicules of the same origin, notwithstanding their widely different appearance.

1. *Sericolophus reflexus* (Ijima, 1894).

Hyalonema reflexum Ijima, 1894, Zool. Anz., p. 366.
Sericolophus reflexus IJima, 1901, Stud. Hex. I., p. 128.

Stat. 122. 1° 58′.5 N., 125° 0′.5 E. 1264—1165 m. 2 specimens.
Stat. 145. 0° 54′ S., 128° 39′.9 E. 827 m. 1 specimen.
Stat. 284. 8° 43′.1 S., 127° 16′.7 E. 828 m. 1 specimen.

Diagnosis. — Sponge shaped fundamentally like a widely expanding and somewhat laterally compressed funnel but very obliquely truncated at the oscular end and with the thinning marginal zone abruptly flexed all around backwards over a part of dermal surface. Seen on either the side exposing the fundus of gastral cavity or on the opposite side, the body outline is oval (up to 159 mm. long by 95 mm. broad), the long diametre indicating the infero-superior direction of the sponge in its natural posture. The conical basal part of body, surrounded by the reflected marginal zone, is inferiorly obliquely inclined and gives rise at the apex to a compact, moderately long and inferiorly directed tuft of basal fibres which are mostly very fine and of a silky appearance. The tuft is not spirally twisted, but shows a slight lateral compression in the same sence as the sponge body and a gentle curvature toward the side of the exposed gastral cavity. The parts of the tuft within the sponge body are divided into diverging bundles without forming a compact axial columella. Numerous round and freely open postica exist on the flatly concave gastral surface. Small groups of prostals (sceptres) may stand on the rounded body edge, formed by the bending back of gastral surface along the oscular margin. In the basal tuft are found the characteristic crooks in abundance. Ordinary basalia, spiny inferiorly, with bidentate anchor in which the teeth are bent somewhat like the frame of a lyre. Dermal pinules pentactine, with spindle-shaped fir-tree-like pinular ray up to 210 μ long; the basal cross with rays about 100 μ long. Gastral pinules similar to dermal, but with somewhat more strongly developed pinular ray. Choanosomal supporting spicules mostly oxyhexactins, occasionally oxypentactins. Intermedial microxyhexactin with rough rays up to 140 μ long. Macramphidisc up to 170 μ long, with hemispherical or truncate hemispherical umbel 60 μ broad and about $^1/_4$ as long as the entire spicule, made up of 5—8 lanceolate teeth; shaft with rounded tubercles; inconstant in occurrence. Mesamphidisc up to 100 μ long by 28 μ broad, with semi-ovoid umbel

about $^1/_3$ as long as the entire spicule or longer, made up of 6—8 narrow teeth; gradating over into micramphidisc which reaches down to 25 μ in length and is found in abundance. Uncinates in two varieties: the macruncinate which may be 2 mm. long, found in vertical disposition to external surfaces; and the micruncinate found in the choanosome, very much smaller and finer, spindle-like and nearly smooth, though the larger ones of it may show obsolete barbation.

Description. — Of this species, originally known from the Sagami Sea, two medium-sized specimens were obtained by the "Siboga" at her Stat. 122, off the northern extremity of Celebes. Both are incomplete in that the basal tuft had been pulled off and nearly entirely lost. The flattened oval-shaped body measures 62 mm. by 37 mm. in one specimen, and 73 mm. by 46 mm. in the other. It is of a soft consistence. The manner in which the expanded gastral cavity is outwardly exposed on one side of the body and a broad zone of the oscular margin is flexed back, is exactly the same as in the Japanese specimens.

A third specimen was obtained at Stat. 145, east of the southern end of the Moluccan island Halmaheira or Djilolo. It consists of a small body fragment in conjunction with some basal needles. The body in the original entire state may have measured only about 35 mm. in length, and the basal tuft about 30 mm. long and less than 2 mm. broad at origin from the body.

A fourth specimen was taken at Stat. 284, south of the eastern end of Timor. It is again a small fragment, consisting of the basal tuft with some body tissues attached to its divided columellar parts.

In all the above specimens the spiculation is fairly the same as that of the Japanese specimens, so that there can be but little doubt as to their specific identity. A full description of the species with illustrations will be published elsewhere. Here I restrict myself to giving the following notes on the spicules, taken from one of the specimens from Stat. 122.

Dermalia with the spindle-shaped pinular ray 170—210 μ long and, together with lateral spines, 30—38 μ broad in the middle; the rhachis 8—9 μ thick at base. Gastralia with similar or somewhat more strongly developed pinular ray, measuring up to 250 μ and 42 μ respectively in length and breadth; the rhachis up to 13 μ thick at base.

Slender sceptres were observed in some number, either partly or wholly imbedded in the reflected marginal zone, with the outer end directed towards the marginal edge.

The basalia consist in part of fine and smooth silky fibres 7.5—19 μ thick, and in part of coarser and stiffer needles up to 95 μ thick. They were all found broken off at the outer end. Along with these spicules and most numerously in the parts near the origin of the tuft from the body, there exist in quantities the remarkable crooks. These measure about 6 μ thick in the inferior crooked parts.

Hypodermal and hypogastral megascleres are moderately strong oxypentactins with the unpaired, proximally directed ray generally much prolonged over the paratangential rays and with all the rays either quite smooth throughout or faintly showing subterminal roughness. Choanosomal supporting megascleres are mostly oxyhexactins, occasionally oxypentactins. They have rays generally more or less bent, and scarcely ever exhibiting subterminal roughness. Intermedial microxyhexactins, armed with small conical spines on rays, are fairly common in the choanosome. They have rays straight, relatively strong, up to 130 μ long and 11 μ thick at base.

Macramphidisc was not discovered. Mesamphidiscs and micramphidiscs are found gradationally

passing over into each other. The former may be 100 μ long; with semi-ovoid umbel up to 28 μ broad and about $^1/_3$ the entire spicule in length, composed of 8, narrow and pointed teeth; shaft spinulate. The latter are similar or relatively more elongate in shape; the smallest may measure 28 μ by 6 μ; umbel with 12 or more teeth.

Macruncinates in radial arrangement under both dermal and gastral surface, reaching nearly 2 mm. in length by maximum thickness of about 9 μ, armed with flatly appressed and rather inconspicuous barbs. Micruncinates found in scattered distribution in the choanosome, 40—76 μ long, uniformly tapering towards both ends, scarcely 3 μ thick in the middle; smooth or nearly smooth, but the larger ones sometimes showing obsolete barbation.

Only in the little specimen from Stat. 145, I have been able to discover some complete basal fibres, preserving the inferior spiny parts and the terminal anchor. The anchor, as seen flat side on, is of a shape somewhat like that of the lyre frame, the two recurved teeth being bent outwards near the tip. Japanese specimens of the species exhibit basal anchors of quite the same shape.

Genus **Semperella** J. E. Gray, 1868.

Hyalonema Semper, 1868. — *Semperella* J. E. Gray, 1868. — *Hyalothauma* Herklots & Marshall, 1868. — *Meyerella* J. E. Gray, 1872. — *Meyerina* Carter, 1872b.

Pheronematid of a columnar or a club-like body shape, without gastral concavity; consisting internally of alternating incurrent and excurrent systems of anastomosing canals, which stand in relation respectively with several dermal and oscular areas distinguishable in all parts of the external surface. Dermal areas covered with uniformly fine-meshed lattice; oscular areas either covered with a larger-meshed lattice or opening through relatively large orifices, found isolated or in close groups. Basalia, arising in separate tufts, join into a matted mass.

A notable feature of this genus consists in the occurrence, on the external surface, of several oscular (exhalent) areas separated by dermal (inhalent) tracts. The oscular area with its sieve-like or otherwise perforated covering, may be regarded, whatever be its real morphological nature, anyway as a thing comparable to the sieve-plated area of certain *Hyalonema* (as f. i. *H. sieboldi*) in all essential respects, save in this that the latter is developed singly, or concentrated to a single definite region, on top of sponge instead of at several places distributed on the sides.

Of this genus there have hitherto been known four species, viz., *S. schultzei* (Semper, 1868), *S. cucumis* F. E. Sch. (1895), *S. stomata* Ij. (1896) and *S. spicifera* F. E. Sch. (1904). For a differential key to these species, see F. E. Schulze, Vald. Rep,, p. 167. The "Siboga" collection contains a form which I regard as a fifth species of the genus.

1. *Semperella similis*, n. sp. Pl. VI, figs. 1—10. Textfig. 2.

Stat. 122. 1° 58′.5 N., 125° 0′.5 S. 1264—1165 m. 2 specimens.

Diagnosis. — Essentially like *S. schultzei* in all macroscopic features, but distinguishable from it in following respects: Pinules of dermal lattice with longer and relatively more slender pinular ray, 160—210 μ long not over 30 μ broad (instead of 83—134 μ by 30—38 μ). Pinules of oscular lattice (oscular sieve) with shorter pinular ray, 190—325 μ long and 22—35 μ broad

(instead of 500 μ and 20 μ respectively in average length and breadth); with longer rays to basal cross, 70—95 μ long (instead of 46 μ maximum length). Intermedial microholactins are slim-rayed, sparsely spiny microxypentactins (instead of hexactins), leading over into an unusually stout-rayed form of same in which the rays may reach up to 150 μ in length and 15 μ in thickness at base and are armed with conical tubercles. Only micramphidiscs found in profusion. Radial macruncinate sparsely present, with short barbs not bent in a hook-like manner; without micruncinates.

Description. — Two specimens of this new species were obtained at Stat. 122, off the northern extremity of Celebes. One of them is a small, much lacerated fragment, measuring 80 mm. by 46 mm. It probably represents the apical end of an individual. Possibly it is a piece torn off from the second specimen, but this I could not make myself sure of. The spiculation was found practically identical in the two specimens.

The second specimen (pl. VI, figs. 1, 2), which I make the type of the species, is a large, moderately well preserved individual, roughly of a columnar or broadly club-like shape. It shows at the upper end signs of having suffered some loss of parts from injury. As it is, the specimen measures 350 mm. in length of body; the breadth at the truncate basal end is 60—70 mm.; that at about the middle of the upper half of body 75—82 mm. In comparison with average specimens of *S. schultzei*, the body appears to be relatively shorter in proportion to its breadth, even though adding into consideration the probable length of the parts that might have been lost at the damaged upper end. The body is nearly straight, though not quite so, being just perceptibly bent, instead of distinctly, in a bowlike way as in fully grown individuals of the species just referred to. However, such differences as the above may be merely a matter that concerns individuals. The same may be said of the differences in macroscopic structure which will soon be pointed out. For making comparisons with *S. schultzei*, I have utilized, in addition to the existing descriptions of that species from the Philippine Islands, the results of my own studies on several specimens from Japanese waters which I hold to be specifically identical with it.

As in *S. schultzei*, the body of the type specimen under consideration may be described as an irregular five-sided prism, with five obtuse or bevelled, longitudinally running edges which divide the external surface into as many longitudinal zones or faces. The two kinds of delicate latticework covering the entire external surface, viz., the dermal (inhalent) and the oscular (exhalent) lattice of a markedly different appearance, are also quite similar in appearance in the two species, except in the stronger development of certain beams in both the lattice kinds in *S. similis*.

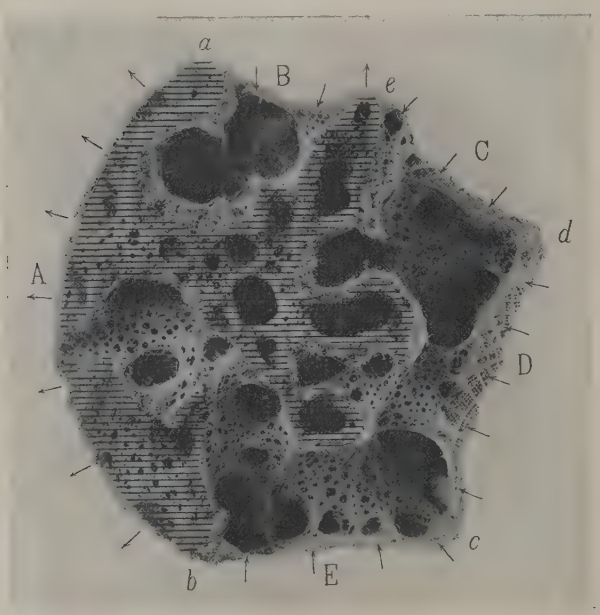
The dermal lattice is finely and fairly regularly quadrate-meshed, the meshes generally measuring not over half a millimetre in length of sides. The beams, made up chiefly of apposed paratangential rays of hypodermal pentactins and which, by intersecting, bring about the latticework, are in part very fine and about as delicate as the same in *S. schultzei*, while certain others are distinctly thicker, attaining a thickness of half a millimetre or over. These thicker beams occur after a succession of a varying number of the thinner ones in the series of beams that take approximately the same direction; so that, the two intersecting series of beams bring about a system of greater meshes bounded by the thicker beams and each inclosing numerous

lesser meshes, i. e., the fine meshes first described, formed by the intersecting of all beams, irrespective of the relative thickness of these. The above greater meshes of the dermal lattice are generally of a rectangular or trapezoidal shape, measuring 2—7 mm. in the length of sides. The same structural arrangement of dermal lattice is also observable in *S. schultzei*, but not so distinctly, because of the coarser beams being not so distinctly thicker than the others.

The oscular lattice exhibits much larger meshes than the dermal. They are of a shape which is generally quadrangular and sometimes more or less roundedly quadrangular. They measure about 1 mm. or over in width. As in the dermal lattice, here also certain of the beams may readily be distinguished, though not with the same degree of distinctness, as being more strongly developed than the rest. In *S. schultzei* I find this distinction among the beams of oscular lattice scarcely possible.

With regard to the above two kinds of covering latticework, a fact deserving special attention is that either of them is plainly a direct continuation of the other, — in other words, that they are to be looked at as local differentiations of one and the same external superficial layer of the skeleton, manifestly standing in relation to the incurrent or excurrent nature of the canalar space underneath them.

Of the five faces of the body surface, there is one (pl. VI, fig. 2; textfig. 2, A) which differs remarkably from any of the remaining four faces (pl. VI, fig. 1). It is on the whole convex throughout its extent, like the side of a cylinder; whereas, all the other faces are, for the most part of their extent, more or less concavely sunk in. The particular face in question is by far the broadest of all, its breadth taking up fully one-third of the entire body circumference. It is further distinguished by the fact that, within its boundaries, the dermal and oscular tracts occur both as irregular patches or bands, lying promiscuously together without definiteness in their relative position. The two tracts are however not equal in extent. The oscular tracts are distinctly the larger on the face under consideration. The inference is that, of the immediately subjacent canalar spaces, the excurrent exceed the incurrent in extent. It goes without saying that this entire face has to do more with egress, than with ingress, of the water. As will soon be shown, the opposite is the case with remaining body sides. Following my former procedure in the case of *Bolosoma paradictyum*, which shows a somewhat similar differentiation on two opposite sides of its body (Ijima, 1903), the side of the body occupied by the above described face, in which the oscular tracts preponderate



Textfig. 2. — Cross-section through the upper part of *Semperella similis* n. sp. Excurrent spaces indicated by striping, in distinction from the incurrent. Arrows indicate the direction of water current. A (between *a* and *b* on the left): the back face of the sponge. B, C, D, E, the four frontal faces of same. *a*—*e*, the five longitudinal edges between every two faces of body. Natural size.

over the dermal, may be called the back of the sponge; and in contradistinction to this, all the rest of the body sides, taken together, may be referred to as the front.

The four faces of the front (textfig. 2, B—E) present each a surface which is covered nearly all over, or at any rate quite extensively without interruption, with the dermal lattice, underneath which are the peripheral parts of the incurrent canal-system as also the spacious subdermal cavity. The oscular lattice, on its part, occurs on the front nearly exclusively confined to the rounded or bevelled longitudinal body edges between every two frontal faces (pl. VI, fig. 1). There it is present either in small patches, following one after another in series or forming an elongate tract on each of the rib-like edges. All in all, the entire front of the body exhibits decidedly more dermal than oscular areas, thus offering to the sponge more inhalent than exhalent surfaces, in counteraction, as it were, to the inverse state of things obtaining on the back. Exactly the same unequal distribution of dermal and oscular lattices on two opposite sides of body is seen in *S. schultzei* also, to which fact I have already called attention on a former occasion (1903, p. 10). In that species the back was found sometimes on the concave side, at other times somewhat more laterally on either side, of the body curved in a bow-like manner. In the specimen of *S. similis*, now being described, it is on the convex side of the very slightly bent body.

The choanosome, as it macroscopically presents itself, may with convenience be described as being made up of a system of irregular, branching and anastomosing tubes with a varying diametre, which at places may reach 15 mm. The wall of the tubes may be about 1 mm. thick at some points, but is considerably thicker in most other parts, up to nearly 4 mm. or thereabout. A number of branch tubes come up to the sponge surface, there to terminate at the several oscular areas before indicated. The labyrinthine lumen of the tubes is nothing else than the excurrent canal system. The intercanal-like spaces between the tubes represent the incurrent canal-system; they are so much like the excurrent canals in sectional outline as well as in calibre, that great difficulty is felt in distinguishing between the two systems of canals. The wall, referred to above as that of the choanosomal tube, constitutes in fact the septal wall between the two continuously distinct systems of incurrent and excurrent canals. It scarcely needs to be mentioned that the incurrent canals end peripherally in the subdermal spaces underneath the dermal lattice. The existence of an axially running, broad excurrent canal, such as was given for the "Challenger" specimen of *S. schultzei* (1887, p. 262), is not recognizable. Nor have I been able to distinguish it in the specimens I have examined of *S. schultzei*. In the subdermal spaces under the frontal faces, wherever the choanosomal tube wall, or outbulgings thereof, come into near approach to the dermatosome, there is a frequent occurrence of the so-called subdermal pillars i. e., spicular strands which always include the proximal rays of certain hypodermal pentactins in their composition and which serve to connect the said parts of the sponge. A different and much more substantial connection between the dermatosome and the choanosome exists where the tube ends stand in fusion with the former, that is to say, at the margin of each and every oscular area. There the abutting tube wall acts as a buttress against the dermatosome, and causes the convexity of the back face as also the ridge-like prominence of frontal body edges, while their absence under the frontal faces largely accounts for the concave sinking in of these.

Actually protruding prostalia were not found on the type specimen of *S. similis*, although some small sceptres were discovered, still contained in the periphery of the sponge. It is to be expected that better preserved specimens will show the sceptres developed into actual prostalia in certain parts of body, probably in much the same way as in *S. schultzei*.

The basal tufts are rather meagerly preserved in the specimen. Thickest tufts arise, downwardly directed, from just outside the border edge of the truncated basal end, while those springing out from the basal surface itself are thinner. The fibres are partly fine and silky, and partly very coarse.

As regards the sponge texture, the specimen is to a degree more firmly built than *S. schultzei* at my disposal for comparison. This is apparently due to the stronger development of certain beams in the superficial covering lattice and to the more densely interwoven state of megascleric rays in the choanosomal septal wall.

It will be seen from the above description that, after all, the disposition and relations of different parts may be said to be essentially the same as in *Semperella schultzei*.

Spiculation. — The pinules of the external surface may be distinguished into those of the dermal and the oscular area, though the difference between the two is by no means so strongly pronounced as in *S. schultzei*.

The dermal pinules (pl. VI, figs. 3, 4) have the pinular ray generally 160—210 μ, on an average 180 μ, long. As a general rule, those which stand on the ticker lattice beams are the longer. The ray, taken together with its lateral spines, is of a rather slender appearance; the greatest breadth in the middle parts of its length does not exceed 30 μ. The rhachis is about 5 μ thick at base; superiorly in the strong parts it may be, or may not be, just perceptibly thickened; anyway it is tapering in the upper parts and terminates with a finely pointed and freely projecting end. The lateral spines are not very numerous. They are longest in the middle parts of the ray or somewhat lower down, not longer than 27 μ, and all directed obliquely upwards after making a very gentle bend soon after their origin from the rhachis. The same ray in the corresponding pinule of *S. schultzei* is shorter, measuring not more than 134 μ long, and of a relatively greater breadth, being invertedly conical or spindle-like in its general shape. — The basal rays are generally 40—65 μ long and 4 μ thick at base; they are quite smooth all over, showing but seldom a microtubercle or two near their outer end. The four basals in the same spicule are usually straight and regularly disposed in a cross; less frequently they are so bent as to bring nearer the ends in each of two opposite pairs of the rays. However, this bending, by which the width of the basal cross is lessened in adaptation to the narrow width of the subjacent lattice beam, takes place very gently and is neither so frequent nor so strongly pronounced as in *S. schultzei*. This is probably in relation to the generally stronger development of the lattice beams in the present species.

The oscular pinules (pl. VI, fig. 5) are in part quite similar to the dermal in all respects, but are on the whole more strongly developed, being provided with a longer and somewhat more numerously spiny pinular ray. That ray commonly measures 325 μ in length, 7.5—11.5 μ in the thickness of rhachis at base, and 22—35 μ in the breadth of the spiny parts. The longest spines, which occur in the middle parts of the ray, may be 23—38 μ long. The ray appears strikingly different from that of the same spicule in *S. schultzei* in being decidedly shorter and

broader, and in the lateral spines being gently bent instead of in a hook-like way, besides being less numerously present. For comparison it may be mentioned that in that species the pinular ray in question shows an average length of 500 μ and a breadth, taking the spines together, of about 20 μ. On the other hand, the basal rays in *S. similis* are much better developed, attaining, as they commonly do, a length of 70—95 μ, while in *S. schultzei* they never seem to exceed 46 μ in length. The said rays in the present species are either smooth throughout or show isolated microspines in a very sparse number. The relatively large size of the basal cross they form, as also the fact that this but seldom shows the gentle 8-like curvature, again appears to stand in relation to the comparatively thick development of the oscular lattice beams on which they are borne.

The pinules, both dermal and oscular, usually stand pretty close together in a row or rows on internodal lattice beams, and in a crowded assemblage on the nodes themselves. With the dermal lattice it seemed to be the rule that its meshes contained each a single large pore, surrounded by a narrow diaphragm-like ring of the dermal membrane, which ring was free of the pinules, except towards the supporting lattice beams. In the oscular lattice the meshes are of course widely open, and the pinules here occur strictly confined to the surface of bounding beams. The oscular pinules, like the dermal, are all radially and outwardly directed in the undisturbed state.

Small pinule-like oxypentactins (pl. VI, figs. 8, 9) occur as canalaria in scattered distribution all over the wall surface of the two canalsystems, not excepting the internal surface of both dermal and oscular lattices. In these oxypentactins the unpaired ray, which is so directed as to project freely into the canalar space, is commonly 83—152 μ long and bears a few, though varying, number of moderately well-developed and obliquely distally directed, branch-like spines. The cruciate basal rays are 60—75 μ long; they are either quite smooth or show one or two prickle-like spinules, pointed obliquely outwards. All the five rays do not exceed 3.5 μ in thickness at base. In a few instances the canalaria were observed in the hexactine form, i. e., with a sixth ray, similar in appearance to basal rays, in addition opposite the pinular ray.

A few cases of the sceptre came under observation; but unfortunately no detailed notes were taken of them at the time, except that they were small and young ones of the usual appearance, still confined with their entire length in the periphery of the sponge body.

The basalia are mostly broken off at the inferior end. The coarser and longer of them have a thickness of 420 μ and a length of 300 mm., of which about 100 mm. are inserted in the sponge body. The finer fibres are 40—75 μ thick. Only the small basalia, less than 4 mm. long, which were picked out in a few examples from near the insertion of basal tufts, exhibited the inferior spiny parts complete, together with the terminal anchor. The anchor is quite like that of *S. schultzei*. Its two broad shovel-like teeth, with irregularly serrate lateral edges, measured 175—200 μ from tip to tip in a straight line. The spiny parts of the shaft do not extend for more than 10 mm. above the anchor. At the upper end of those parts, the shaft is not more than 60 μ thick.

The megascleres, which with their paratangentially directed rays go to form the principal supporting elements of the beams of both dermal and oscular lattices, are smooth macroxypentactins of a vaying size. They are quite often irregularly shaped in that the rays may vary much in

length in the same spicule. By excessive shortening of its one or two rays, the macropentactin frequently approaches more or less the form of a tetractin or a triactin, if not factually converted into such as it sometimes is. Further, the irregularity of shape is brought about by the bending of rays and by deviations from 90° of the angles they make with one another at the spicular centre. In extreme cases of the latter kind of variation, the four paratangential rays may start from the centre in two pairs, taking opposite directions. The paratangentials, when excessively developed, may reach nearly 10 mm. in length with a thickness of 175 μ at base. The proximally directed, unpaired ray is either short or long, according to the situation of the macropentactin. It is very short, or may even be reduced to a mere boss, in all those macropentactins which have their central parts placed in the lattice, extending freely over a canalar space, regardless of this being subdermal or suboscular. On the other hand, where there exist connections between the superficial lattice and the choanosomal septal wall, viz., in the so-called pillars and at the junction of the lattice with the septal wall, in the border-line between dermal and oscular areas, the said ray running in those connections is much prolonged and serves to nail, so to say, the superficial structure firmly to the deeper parts. Some, but not all, macropentactins at the junction of septal wall with the covering lattice, approach the peculiar form known of the same spicule in *S. cucumis* and *S. spicifera*. In that form of the spicules the cruciate paratangentials are all short (1 mm. or shorter) and stunted-like, while the unpaired proximal ray is greatly prolonged (reaching 9 mm. in length) and is thickest (up to 300 μ), not at base, but some distance nearer its middle.

The choanosomal supporting megascleres are, as a rule, likewise smooth oxypentactins of a medium or large size, more or less irregular in shape. Exceptionally they may take the form of a stauractin, otherwise of such a tetractin as results from the suppression of two rays belonging to different axes. Inequality in the length of rays and variation of the angles, formed by these at the spicular centre, are very common. In the larger of these spicules the longest ray may measure 15 mm. long and 120 μ thick at base. A ray in a spicule may be so short as to be only 1 mm. or less long, while the other rays are several times longer. By no means uncommon among the spicules, are pentactine forms in which the unpaired ray is conspicuously shorter than any of the others, or in which two rays in an axis are greatly prolonged over the three remaining. In the latter case the spicule may be 30 mm. or more in length. Of no less frequent occurrence are such pentactins as have all the rays developed to a great length but have one of them more or less bent, in extreme cases even to such a degree, that all the five rays come to lie nearly in a plane. Further, the rays, soon after origin from the centre, may take such directions, whereby the pentactin is enabled to participate in the formation of one and the same spicular bundle, or of nearly parallel adjacent bundles, with all its five rays or with any four of them.

Once, in a thick section through the junction parts of the septal wall with the covering lattice, I have come across a spot of a limited extent, where certain intersecting megascleric rays were found to be rigidly fused together. I am inclined to view this as an occurrence of abnormal nature.

As intermedial spicules of the skeleton, there occur oxypentactins of a small or medium size, with spiny or prickly rays. They are found in great abundance not only in the choanosome,

but also on the underside of the superficial covering lattice. They may be taken for the microholactin of the species, though varying very considerably in the development of rays and spiny armature. In the smaller and more weakly developed examples of it (pl, VI, fig. 6), the rays are slim, generally measuring 75—114 μ long and only about 3.5 μ in basal thickness. They bear a sparse number of rather slender spines of a varying length, which at times stand out somewhat vertically, but are more generally obliquely distally inclined. Such slender rayed spiny microxypentactins are nearly comparable in their appearance with the microxyhexactin of *S. schultzei*. In the present species they pass over gradationally into a larger, more robust-rayed and profusely short-spiny form of microxypentactins (pl. VI, fig. 7), a like of which is not found in the species just referred to. The rays grow up to a length of 150 μ and a basal thickness of 15 μ, while the spines greatly increase in number, acquiring at the same time a conical shape. Stout oxypentactins of this description are especially common in the choanosome. Derivative form of spiny microxyhexactin in which two prolonged rays in an axis remain spiny while the four remaining rays in two axes are short and simple, a form which is common in *S. schultzei*, is not found in this species.

The small slim-rayed examples of the above spiny microxypentactin also pass over gradationally into the pinule-like canalaria before described. The transition consists simply in the stronger development of the unpaired ray and of its obliquely distally directed spines, while the four paired rays undergo reduction in both their dimensions and spination.

As regards the amphidisc, the remarkable fact is that macramphidisc and mesamphidisc are both entirely missing in all the preparations I have made of the specimen. However, this may not signify their constant absence in the species. On the other hand, the micramphidisc is very profusely represented, occuring in greatest number in the dermal membrane and much less numerously in the canalar wall. Length 17—23 μ; breadth of umbel not more than 8 μ, and depth of same $^1/_4$—$^1/_8$ the entire length of spicule. Each umbel, hemispherical or semi-ovoid in shape, consists of fine teeth about 20 in number.

Finally, the uncinates are represented only by large form, the macruncinate (pl. VI, fig. 10), which occur in no great abundance at the junctions of choanosomal septa with the superficial lattice. It is radially disposed, with the thicker head-end always directed outwards and placed close to the external surface. Nowhere were the macruncinates found in sheaf-like groups, but nearly always isolated. They reach 3.5 mm. or over in length and 23 μ in greatest thickness. They differ from the corresponding spicule of *S. schultzei* in having shorter and nearly straight barbs, not bent in a hook-like manner as in that species. The peculiar, relatively thick micruncinate from the choanosome of *S. cucumis*, *S. spicifera* and *S. stomata* does not seem to exist in the species.

Remarks. — Notwithstanding the great similarity in external appearance of the "Siboga" *Semperella* from the north of Celebes to *S. schultzei* of the Philippines and Japan, the differences in spiculation are conspicuous and seem sufficient for specific distinction of the former from the latter. Granting this, there seems to exist some justification in calling for a renewed examination of those *Semperella* specimens which are known to have been obtained at localities further south than Celebes and which have hitherto been referred to *S. schultzei*. There are two such specimens on record, viz., the one from Ceram which should exist in the Leyden Museum and which was first described by Herklots and Marshall (1868) under the name of *Hyalothauma*

ludekingi, but was later referred to *S. schultzei* by the latter author (1875); and the second obtained by the "Challenger" at a station near Little Kei Island and regarded by F. E. SCHULZE to be a young of *S. schultzei* (Chall. Rep., p. 265). The existing descriptions of the above two specimens, although good so far as they go, yet do not go far enough into the characteristics by which it can be determined if they are really *S. schultzei* and not *S. similis*. Thus, it is not altogether impossible that, in giving the "Siboga" specimen a new specific name, as I have done, perhaps only a synonym was added to a species which, according to the usage in zoological nomenclature, is entitled to be called *S. ludekingi* (Herkl. & Marsh.) in distinction from *S. schultzei*.

Family MONORHAPHIDIDAE n. fam.

Amphidiscophora with uncinate; choanosomal supporting spicules predominantly tauactins, elongate in the complete axis and sometimes passing over into rhabdodiactin form by suppression of the unpaired ray; basalia a single, excessively strongly developed needle. Sponge body like a somewhat laterally compressed cylinder, with excurrent canalar orifices, irregularly distributed on surface, and showing on one body edge a longitudinal series of niche-like depressions covered with a sieve-like lattice.

The genus *Monorhaphis*, which F. E. SCHULZE (1904) associated with *Semperella* in his *Semperellidæ*, exhibits a spiculation so markedly peculiar in some important respects, that I think it might well be made a family or a subfamily by itself in the Amphidiscophora.

As an important character of the family is to be regarded the tauactine development of most choanosomal megascleres. Hexactine form of same occurs but rarely. By suppression of the relatively short unpaired ray the tauactins may sometimes take the form of a rhabdodiactin; but rhabdodiactins, demonstrably of that mode of origin, should in the systematic be held in distinction from those, derived directly from the hexactin, the pentactin or the tetractin by simultaneous suppression of rays, except the two in one axis which remain. The rhabdodiactin which occurs as choanosomal megascleres in the Hyalonematidae (as also in the tribe Lyssacinosa) appears to belong, though probably not exclusively, to the latter kind.

Macropentactins occur as supporting spicules of the superficial covering skeletal layer. Their paired paratangential rays are supplemented by tauactins, similar to those of the choanosome, in forming the beams of that layer.

Microxyhexactins with slim rough rays are present as intermedial scleres in the choanosome.

The sceptre, in fact prostals of any sort except the basal needle, is unknown in the genus.

The remarkable basal needle, known as the stake-needle, is probably a monactin in agreement with the basalia of the Amphidiscophora generally. Since its natural inferior end has never yet come under observation, nothing definite can be said about the anchor. Acanthophores do not occur. Instead of them, there are, in a comitalia-like arrangement around the parts of the stake-needle, imbedded in the body, tauactins similar to those of the choanosome and rhabdodiactins of evidently tauactin derivation.

Genus **Monorhaphis** F. E. Schulze, 1904.

With characters of the family.

As this most remarkable genus was instituted by F. E. Schulze in the "Valdivia" Report (p. 167), two species were ranged under it, viz., *M. chuni* F. E. Sch. and *M. dives* F. E. Sch., both from off the eastern coast of Africa. In the same report (p. 158) the author has pointed out that his *Hyalonema fruticosum* (1893, p. 30), from the west of the Philippines, first described by him in the "Challenger" Report (p. 233) as *Hyalonema* sp., is in al probability a *Monorhaphis*. Indeed, from what is known of its most characteristic spicules, there can scarcely be a doubt that we have here to deal with a form which, according to the usage in zoological nomenclature, should properly be called *Monorhaphis fruticosa*; but whether this name really represents a distinct species or is simply a synonym of either of the surely known *Monorhaphis* species, must remain undetermined until we shall have gained a more exact knowledge of the form in question.

The "Siboga" collection contains a specimen which may be identified, though not with entire satisfaction, owing to its incomplete condition, with *M. chuni*.

1. *Monorhaphis chuni* F. E. Schulze, 1904. Pl. VI, figs. 11, 12. Textfig. 3.

F. E. Schulze, 1904, Vald. Rep., p. 112; pls. XL—XLII, etc.

Stat. 284. 8° 43′.1 S., 127° 16′.7 E. 828 m. 1 specimen.

Diagnosis. — *Monorhaphis*, characterized by abundant presence, in the external covering layer, of barrel-shaped macramphidiscs of over 300 μ length, in which the teeth of both umbels, usually 8 in number to each, often meet at the equator and are fused into meridional bands; without mesamphidisc.

The only other surely known species of the genus, *M. dives* F. E. Sch. from off the Somali coast, should be devoid of the above macramphidisc, but have numerous mesamphidiscs up to 150 μ long and with 12 or 13 teeth to each umbel.

Description. — The specimen, which I refer to this most remarkable genus and species, hitherto known only from the East African coast, was obtained by the "Siboga" at her Stat. 284, a spot to the south of the eastern end of Timor. Unfortunately it is in an incomplete and badly mutilated condition.

The specimen consists of two pieces contained in the same bottle. Of these the smaller (pl. VI, fig. 11) is a soft mass of an oblong and laterally compressed shape, about 70 mm. long, 35 mm. broad and 27 mm. thick. While its one end bears signs of having been torn off, the other end, which is unevenly rounded, is apparently entire. The piece evidently represents one of the natural ends of the elongate sponge body. Presumably it is the apical portion severed off from the upper end of the larger second piece (pl. VI, fig. 12). This piece consists of an irregularly shaped, but long and distinctly laterally compressed sponge mass, 26 mm. long and in the broadest parts about as thick and broad as the first mentioned piece. Longitudinally along one of its edges and nearly, but not quite, superficially exposed, there runs a pretty close bundle of coarse, parallel needles, manifestly the comitalia of the enormously sized basal

needle called by F. E. SCHULZE the stake-needle ("Pfahlnadel"), which, in the specimen on hand, had been pulled off and lost. The said bundle of comitalia is gently bent, and the sponge mass is attached lengthwise to its slightly concave side. One end of the bundle --- obviously the superior end — projects out free for a length of about 70 mm.; so does also its other end for a short distance. In the former all the component needles taper out towards the free tip, while in the latter they all show a fractured end, some of them being here nearly 700 μ thick. In both these free parts the needles are covered with, as well as joined together by, remnants of the soft sponge tissue, indicating that the parts originally lay imbedded in the body. In the lower parts of the specimen the comital bundle is about 7 mm. thick and is internally hollow, being traversed by a longitudinal canal of about 4 mm. width in the lowest parts. Needless to mention the relation of this canal to the lost stake-needle. Its wall is smoothly lined with a transversely fibrous tissue, the "fibrospongin" sheath F. E. SCHULZE's (Vald. Rep., p. 208). The canal seems to extend a long distance superiorly in the comital bundle, though this forms in the uppermost parts a nearly solid fascicle.

The much lacerated external surface of the sponge shows identations and irregularities which in part are no doubt due to mechanical injuries. There exist on the surface a number of round or roundish apertures of various sizes, up to about 5 mm. in diametre, in irregular distribution. These are without doubt the external orifices, called by F. E. SCHULZE the oscular openings of the excurrent canal-system. The general external surface between these orifices, assumed by F. E. SCHULZE to be the dermal, preserves the superficial covering only here and there in the intact state. At such places the surface is uneven, sometimes even rough looking, a feature which seems not to agree quite with the condition of the same spaces in the "Valdivia" specimens. It appears at places densely granular or even almost compact, owing to the closely crowded presence of pinuli; at other places it distinctly shows a delicate lattice-like structure, consisting of thin spicular beams, which, together with the soft reticular membrane occupying the mesh-spaces, bears the pinuli in a close row or rows. The said supporting beams intersect one another at varying angles, thus forming an irregular network with meshes of no definite shape or size. The larger of the meshes may measure 0.5—1 mm. across.

As regards the peculiar sieve-covered concavities, described by F. E. SCHULZE under the name of "niches" from the "Valdivia" specimens, the "Siboga" specimen is not in a state which allows an exact observation to be made on them. What may possibly be regarded as an indication of a niche was found close to the upper torn end of the larger piece. There exists at that place a small ill-defined tract of the superficial covering layer, which is quite sieve-like and well distinguishable from the above described covering of other parts of the sponge surface by exhibiting nearly uniformly and regularly quadrate-shaped meshes, measuring about 1 m. in the length of sides. That particular tract of the covering layer with the indicated characterization may, for the sake of easy reference, be called the sieve. Its rectangularly intersecting beams bear the usual superficial pinules on the outer side. The underlying moderately wide space or spaces show canalar pinules on the wall in scattered distribution, in agreement with the similarly situated spaces in other parts of the sponge. Unfortunately, the tearing away of much tissues in the immediately adjoining parts, has rendered the natural condition of the area covered by the sieve, difficult to be exactly made out. Nevertheless, from circumstances

of the situation of the sieve, it seems acceptable that it probably formed a part of the wall of a concavity of the sponge surface, which might well have looked like a niche. If certain abraded depressions or indentations, existing in other parts of the same sponge piece, are natural ones, which were originally lined with a sieve, similar to the one just described, can not be determined.

Possibly, as it occurs to me, that the above sieve marks the site of a niche, there is a point with respect to its position on the body, which does not stand in agreement with what is known of the niches of the species. From F. E. SCHULZE's representations one should expect to find the niches arranged in a series, one below another, on that edge of the laterally compressed body which is longitudinally traversed by the eccentrically situated stake-needle. If now the aforesaid sieve really represented a niche, the position of this in the "Siboga" specimen must be said to differ from the normal one in that it is situated, if not quite on the reverse side, anyway clear off the body edge containing the stake-needle sheath. At the same time, there exists no indication whatever of a niche on that body edge, and this can hardly be the result of a loss by damage to the parts, as judged from the fact that these have, to a large extent, preserved their natural external surface covered with pinules. But, after all, in view of the very unsatisfactory state of preservation of the specimen I refrain from drawing conclusions regarding its niche or niches.

As regards the morphological and physiological nature of the niches and of the rest of the external body surface in this species, we have as yet only an imperfect knowledge. F. E. SCHULZE seems to regard the niches to be specially developed excurrent or oscular areas, comparable to the sieve-covered oscular areas of *Semperella* or to the depressed gastral surface of *Pheronema*, occurring in addition to the numerous orifices found scattered on other parts of the body surface, concerning which orifices there can scarcely be a doubt as to their being external outflow apertures of excurrent canals. The surface on which these orifices are situated was taken by the same author for the dermal, as before mentioned. Now it occurs to me that there is really nothing much standing in the way of holding just the opposite of F. E. SCHULZE's assumption. The niche surface and the other surface might as well be regarded to be those, corresponding respectively to the dermal and the oscular area of *Semperella*. A decision on the point can be given only with a precise knowledge, which we have not at present, of the disposition of the ends of flagellated chambers in relation to the surfaces in question.

Spiculation. — In this the "Siboga" specimen agrees nearly completely with the description and figures given by F. E. SCHULZE in the "Valdivia" Report, so that I feel uncalled for to describe it in full.

The pinules (textfig. 3) of the external body surface, those of the quadrate-meshed sieve inclusive, have pinular rays somewhat plumose-bushy in appearance, generally 190 μ (seldom 170 μ) long and about 38 μ broad in the middle of the upper half of its lenght. Longest lateral spines may be 34 μ long. The rhachis is usually about 5.5 μ thick at base; it is spineless in the basal parts for a length of 23—34 μ. Subapically it shows a small but distinct inverted-conical swelling with 4 small tooth-like processes on the margin, and an apical cone projecting freely from the centre, of the truncated cone end. This condition of the apical end of rhachis is fairly in agreement with that figured by F. E. SCHULZE from the identical pinule of *M. dives* (Vald. Rep. pl. XLII, figs. 12, 15, 16). The basal rays, 45—53 μ long,

are always distinctly swollen at the end, unlike F. E. SCHULZE's representation of same in his Pl. XLI, fig. 1 (Vald. Rep.). The swelling itself is conically pointed at tip and bears a few obliquely distally directed microspines.

The canalar pinules, fairly numerous at some places but quite isolated present at others, differ from the above in being smaller and weaker in the development of parts. Pinular ray with a varying number of lateral spines, 75—100 μ long; the peculiar subterminal toothed swelling observable only in the better developed cases of the ray. Basal rays 38—50 μ long, terminally slightly or not at all swollen, with a few obsolete tubercles near the end.

Textfig. 3. — A pinule from the external surface of *Monorhaphis chuni* F. E. Sch. × 300.

The sceptre was not discovered. It seems the species is devoid of it.

As already mentioned, the stake-needle had been lost, but its comitalia remain. These I have found to be strong rhabdodiactins. Their direct derivation from the tauactin is in many cases indicated by the presence, at or near the middle of their length, of an unilateral knob, the vestige of the last suppressed ray. A small comital I have extracted, measured 60 mm. long by about 400 μ thick in the middle, while a large one, incomplete in one ray, was 80 mm. long and nearly 700 μ thick at the fractured end. The irregularly bent needles, found by F. E. SCHULZE in the neighbourhood of the stake-needle and considered by him to be abnormal or pathological forms, seemed not to occur in the "Siboga" specimen.

The beams of the delicate superficial lattice, covering the entire external surface of the sponge, are supported by paratangential rays of macroxypentactins, supplemented by a number of elongate tauactins apposed to them. The pentactins have paratangentials reaching 550 μ in length and 35 μ in thickness at base; the proximal unpaired ray is generally much longer and somewhat thicker than them in the same spicule. In certain examples of the spicule the proximal ray was found to be thickest some distance from its base, after the manner, though not in the same prominent degree, of the hypodermal pentactins of certain *Semperella* species. The tauactins in the lattices are similar to those of the choanosome. In not a few cases of them there existed, in addition to their three rays, a fourth rudimentary ray, and sometimes a fourth and a fifth, representing different stages of the derivation of the tauactin from the pentactin.

The principal supporting spicules of the choanosome are elongate tauactins of a rather small size, in which the unpaired ray is relatively very short. Ordinarily the two rays in one axis do not exceed 2.5 mm. in total length and 35 μ in thickness near the spicular centre, while a small example of the kind is less than 1 mm. long and proportionally thin. The rays are smooth, apparently without tubercles but often somewhat irregularly contoured; the ends are obtusely pointed, not infrequently rounded.

As accessory elements to the choanosomal skeleton there is a not uncommon occurrence of regular delicate-looking microxyhexactins with obsoletely rough or nearly smooth rays 55—150 μ long and only about 2 μ thick. These slim-rayed microholactins may under circumstances assume the pentactine form.

The characteristic barrel-shaped macramphidisc, in which the teeth of both umbels meet and are fused together at the equator, is very common in the superficial covering layer of

the sponge surface. It can be recognized under the lens as shining points. Length 310—330 μ; breadth at the equator 200—242 μ; number of teeth usually 8 to an umbel; the axial shaft with a whorl of tubercles around the centre. On the truncated polar area is seen a circle of what appears like small holes, each situated at the origin of umbel teeth. Frequently their number does not reach up to that of the teeth, so that some of these are without one at base. In a single case of the macramphidisc I have not been able to observe anything like holes on either pole. In another case I could not but believe that a hole existed between the bases of every two umbel teeth. F. E. SCHULZE had observed the holes irregularly scattered on the polar area, their number not seldom running up to ten or twenty in each.

Amphidiscs that may be called the mesamphidisc are wanting in the species. The micramphidisc occurs in a sparse number in the external covering layer and in choanosomal septa, but are found in abundance in the proximity of the stake-needle sheath. Length 23—29 μ, seldom 38 μ; the umbel about 10 μ broad and about one-fourth as long as the entire spicule; teeth fine, 15 or more in each umbel; axial shaft faintly rough or nearly smooth, not thicker than 3 μ and therefore not so unusually thick as was found by F. E. SCHULZE in the "Valdivia" specimens of the species, nor as in *M. dives* and *M. fructicosa*.

Uncinates in radial arrangement in the periphery of the body occur at some places in in a moderate abundance, at others very numerously together in sheaf-like groups. They are comparatively small, measuring not over 700 μ in length and about 5 μ in maximum thickness. They attenuate nearly, though not quite, equally towards both their end. The barbs lie low, and are inconspicuously small and thin.

Family HYALONEMATIDAE J. E. Gray, 1857, emend.

Hyalonematidae F. E. Schulze (1904, p. 181), partim.

Amphidiscophora as a rule without uncinate; choanosomal supporting spicules all or in a large proportion rhabdodiactins, in the latter case occurring in association with macrohexactins or macropentactins; marginalia pinular rhabdodiactins; basal fibres with anchor, consisting of an inverted-conical swelling, furnished with a circle of several short teeth, forming a single basal tuft of which the parts within sponge body form a compact axial columella.

The Hyalonematidae are here presented in the scope of comprising only the four genera; *Chalaronema* n. g., *Hyalonema* J. E. Gray, *Lophophysema* F. E. Schulze and *Compsocalyx* F. E. Schulze.

The body is exceedingly variable in form. Fundamentally it may be said to be of a spheroidal or ovoidal shape, with long basal fibres springing out ordinarily in a single tuft from the inferior pole [1]). It is axially traversed right through by the upper prolongation of

1) R. v. LENDENFELD (1915, p. 201) has recently described *Hyalonema polycaulum* with more than one basal tuft, though as usual with a single gastral cone in connection with one of the tufts. However, I think it may be doubted if the presence of supernumerary tufts is really a normal character of the species and not an accidental or teratological phenomenon of the single specimen known of it.

the basal tuft, known as the columella. The apical end of this may give rise, at the superior pole of body, to a small projection called the gastral cone. The excurrent canals open externally at the upper body end in a distinctly circumscribed area, the incurrent area (oscular or gastral area, Ausströmungsbezirk), which has the gastral cone for the centre and is marginally sharply bounded against the dermal or incurrent surface by an edge-line, the oscular margin. Within that area the separate excurrent canals open either directly each for each after combining into some large common canals. In the latter case, combined canal of the most prominent calibre (subcentral canals), usually four in number, are situated along and around the columella and separated from one another by longitudinal radial septa which connect the axial parts of body with the peripheral. All the external apertures of excurrent canals — in fact, the entire excurrent area — may be covered over by a continuous lattice-like layer; or, they remain all freely open, without an external covering. The excurrent area, irrespective of its being provided with the covering layer or not, may form a flattened surface at the truncated upper end of a mallet-like or inverted conical body, there then existing no or scarcely any concavity which may be called the gastral cavity. In such cases, the superficially flatly exposed covering layer of the area is commonly spoken of as the oscular sieve-plate. At other times, the entire excurrent area is inwardly depressed, thus giving rise to a more or less manifest concavity which we are used to call the gastral cavity. In still other cases, the same area, instead of being flatly extended or concavely sunk in, bulges out externally so as to present an outwardly exposed, convex gastral surface at the upper part of body. In the extreme case of this process being carried out (*Lophophysema*), the excurrent area forms a major part of the external body surface, while the incurrent or dermal surface is, in its turn, largely pushed inwards in the form of deep invaginations.

As regards the spiculation of the family, in distinction from that of the Pheronematidae or of the Monorhaphididae, the following may be mentioned as the more notable points.

1. The absence of the uncinate, apparently owing to its secondary loss, in most, perhaps all, of the species. Cfr. foot-note on p. 6.

2. The absence of the scepter, the characteristic monactine prostal needle of the Pheronematidae. Cfr. p. 7. In the Hyalonematidae the marginal prostals are always rhabdodiactine pinules obviously most closely related to the pentactine pinule of the sponge surfaces. Pleural prostals, known only in *Compsocalyx*, are entirely smooth rhabdodiactins, presumably derived from among those of the choanosome.

3. The basal fibres ordinarily, perhaps always, form a single tuft to each individual. Cfr. foot-note on p. 41. The tuft is usually compactly bundled, and after growing to a certain thickness and length, may undergo spiral twisting. This invariably takes place dextrally, so that, in the side view of the tuft, each and every fibre is seen to run from the left above obliquely downwards to the right below.

4. The anchor of basal fibres, in all the cases it has been discovered, is an inverted conical knob with a circle of usually 4—8, obliquely upwardly directed, short teeth, instead of being bidentate and shaped somewhat like a two-fluked ship's anchor as in the Pheronematidae.

5. The apparently general occurrence, in the parts of the exit of basal tuft from body, of the acanthophore which is unknown in both the other families.

6. The invariable occurrence of rhabdodiactins in a very large proportion among the choanosomal megascleres. Sometimes these consist exclusively of that kind of spicules, the hexactin having entirely disappeared from amongst them, though it may still exist as the intermedial microholactin (microhexactin).

Differential key to the genera.

A. Without pleural prostalia or conical projections of dermal surface.
  a^1. Entire dermal surface externally exposed. Gastral area with or without superficial covering layer.
    a^2. Basal tuft broad, rather loose, not twisted. With oscular sieve plate . . . . . **Chalaronema** n. g.
    b^2. Basal tuft compact, generally twisted after full growth. Gastral area superficially exposed, or depressed into gastral cavity, or extensively outbulged; with or without sieve-plate or gastral covering layer . . . . . **Hyalonema** J. E. Gray, 1832.
  b^1. Dermal surface in part deeply sunk in the form of pits; latticed gastral area bulged out like a dome and forming a major part of the external body surface . . . . . **Lophophysema** F. E. Sch., 1900.
B. With wisps of pleural prostalia on conical prominences of dermal surface. Subcentral canals freely open, without oscular sieve-plate . . . . . **Compsocalyx** F. E. Sch., 1904.

The "Siboga" collection contains the genotype af *Chalaronema* n. g. and 11 species of *Hyalonema* J. E. Gray, beside some undeterminable forms.

Genus **Chalaronema** n. g.

Like *Hyalonema* J. E. Gray but differing from it in having a broad and rather loose, untwisted basal tuft, to which fact the generic name refers. Represented by the following single species.

1. *Chalaronema sibogae* n. g., n. sp. Plate II, figs. 1—10.

Stat. 251. 5° 28′.4 S., 132° 0′.2 E. 204 m. 2 specimens.

Diagnosis. — Body subcylindrical, with thin-beamed oscular sieve-plate at the truncate upper end; the rounded lower end giving rise to a broad and rather loose basal tuft which is not twisted. Dermal pinules with elongate conical and plumose pinular ray up to 150 μ, the finely pointed end of rhachis freely projecting at apex. Pinules of sieve-plate very much taller and more robust, the profusely spiny pinular ray reaching a length of over 800 μ. Pinules of main internal canals small, not numerous, the free ray sparsely and weakly spiny. Basalia

with 4-toothed anchor; the shaft spiny in the lower parts, but superiorly in the thickest parts with interruptedly spiral denticulate ridge. Choanosomal supporting spicules rhabdodiactins, without macrohexactins among them; tignules up to 10 mm. long and 300 μ thick. Ambuncinate present, 2 mm. long or longer, sparsely spined in all parts of its length. Intermedial microholactin mostly in the form of stauractins varying much in size but not over 180 μ in length of rays. Acanthophores mostly rather slender-rayed stauractins. Macramphidisc 275—310 μ long; umbel semiovoid, 8-toothed, 100—120 μ broad and 90—100 μ long; the teeth broad, rounded at end; the axial shaft smooth but with a whorl of tubercles in the middle. Without mesamphidisc. Micramphidisc of the usual character, not abundant.

Description. — This interesting new genus and species was obtained by the "Siboga" at her Stat. 251, south of Kur I., one of the Kei Is. There are two specimens of it, which will be called specimen A and B in this description.

Specimen A (pl. II, figs. 1, 2) is made the type of the species, it being the better developed of the two and nearly completely preserved in all its parts. It was severed longitudinally into two halves, but these have remained together, thanks to some basal fibres which had wound around them. The body is approximately cylindrical, measuring about 60 mm. long and 30—35 mm. broad. It is somewhat truncate above and rounded below. The texture of the sponge is soft. From the slightly depressed central space of the lower end there spring out the long basal fibres in a broad and ample tuft, about 10 mm. or more in breadth at the origin. The longer fibres protrude to a length of 100 mm. or more. The fibres, partly very fine and partly rather coarse, are rather loosely bundled together, at any rate not so compactly as in most *Hyalonema* species. The entire tuft is not straight, but is bent almost to a semicircle, which may be due, in part at least, to the fact that the specimen has been kept in a close bottle with the tuft doubled up. It bears no indication of the twisting usually seen in *Hyalonema* tufts. From its general condition, which is much like that of the basal tuft of *Sericolophus* or of certain other Pheronematids, it is exceedingly unlikely that the tuft will yet undergo twisting at a later period of the sponge's life.

Superiorly the basal tuft is continued into the body and traverses axially right through its length as a single well-defined columella. This attenuates towards the upper extremity and consists of parallel running fibres, not very tightly pressed together.

The dermal surface is, apart from some wrinkles which were probably brought about by shrinkage, moderately smooth. It shows a hypodermal lattice with irregularly quadrangular meshes of 1.5—2 mm. width. These are at places nearly continuously filled up by dermal pinules in a layer; at other places the pinules are found on and along the hypodermal beams, leaving open a central space in the meshes. The truncate upper end of the body is occupied by an even oscular sieve-plate of an irregular outline, measuring about 25 mm. across. The meshes of this plate are mostly triangular or quadrangular with rounded corners; their width is 2 mm. or under. The beams are thin, but broaden towards the nodes. Under the lens the long oscular pinules are discerned standing spine-like on the beams. In a part of the sieve-plate circumference the marginal cuff of 2—3 mm. width is preserved. At the centre of the plate there exists a small gastral cone. Through the meshes are seen a number of excurrent canalar apertures, of which the four in cruciate disposition around the columella are especially wide,

measuring 7—11 mm. across; they lead into correspondingly wide subcentral canals which penetrate deep into the body. The radial septa between them stand at the edge in direct connection with the sieve-plate by means of the pillars. Thus, the gross structure of the sponge body is essentially the same as in certain *Hyalonema*, as f. i. *H. sieboldi.*

Specimen B, from the same station, is a young of an ovoid shape and of about the size of the pigeon's egg. An untwisted bunch of fine basal spicules projects at one end. Here again, it is somewhat bent and consists of fibres which are rather loosely set together. At the opposite end of the body there exists a small and laterally flattened apical flap, the gastral cone. The specimen is of special interest in that its oscular sieve-plate is apparently at an early stage of development. On one side of the flattened gastral cone and half surrounding it, there exists a small crescent-shaped slit, leading internally into some of the excurrent canals. The outer upturned edge of the slit is fringed with diactine pinules and represents without doubt a segment of the developing marginal cuff. The slit itself is not quite freely open, but shows some thin spicular trabeculae running irregularly across it, or rather across the entrances into the excurrent canals within. These trabeculae can not be anything else than first formed beams of the growing oscular sieve-plate. On the beams there is a sparse occurrence of pentactine pinules, which do not differ much from the ordinary dermal pinules of the specimen in both appearance and dimensions. The pronounced difference in development, observable between dermal and oscular pinules in specimen A, seems to be a matter which sets in at a later stage of growth than that represented by the little specimen under consideration. On further growth of the sponge, I assume, the narrow space occupied by the inceptional sieve-plate extends completely around the gastral cone, taking this into the centre and widening itself all the while as the plate advances towards acquiring its definitive character. The way indicated of the development of the oscular area and the sieve is in unison with my observations on the young of *Hyalonema sieboldi* with regard to the same matter.

Spiculation. — The following description of the spicules is primarily based on observations on the type specimen (A). Statements in reference to the other specimen (B) are given in parenthesis.

Dermal pinules (pl. II, fig. 3) have the distal pinular ray generally 140—150 μ (in B 110—140 μ) long and of a plumose or fir-tree-like general appearance. The rhachis of that ray is about 7 μ thick at base and tapers thence towards the finely pointed apex, without thickening itself in the spiniferous parts. It remains spineless for about 20 μ at base. The lateral spines are not very numerous, there being visible on each side generally 5—8 of them at one and the same focus of the microscope. The first, the second or the third spine from below on either side is usually the longest, measuring 20—23 μ in length. The entire pinular ray is broadest at about the level of the ends of the longest spines. In that part it is about 40 μ (in B 27—38 μ) broad. Thence distally, the spines grow gradually shorter and somewhat less curved, at the same time springing out ever more obliquely from the rhachis. The finely pointed tip of rhachis may project free for a length of 20 μ or more beyond the end of the last spine. The cruciate basal rays are 53—68 μ (in B 40—53 μ) long and not over 6 μ thick at base. They narrow gradually towards the sharply pointed end. Their surface show a sparse number of microtubercles.

Oscular or gastral pinules, i. e., the pinules on the beams of the oscular sieve-plate, are distinguished by their remarkable tallness and strong development (pl. II, fig. 4). In comparison with the much smaller dermal pinule, the discrepancy in size is very striking and may attain to a degree but rarely approached to by other known Amphidiscophora. The rhachis of the pinular ray reaches a length of 800 μ and sometimes even more. It is 11—15 μ thick at base and grows perceptibly thicker above in the spiniferous parts, but finally tapers to the finely pointed and freely projecting tip. The breadth of the ray, together with the lateral spines up to 65 μ. The spines are very numerous, beginning to occur from the base of rhachis. Short and conical at first, they grow longer but more slender further above and spring out from the rhachis at an angle of about 30° or less. The basal rays are 75 μ long and 12 μ thick at base. They are sparsely microtuberculate. (Mention was already made of the fact that in specimen B the dermal and oscular pinules were found to be nearly alike in both dimensions and general appearance).

Diactine pinules occur in some numbers on the cuff edge, similarly as in *Hyalonema*. Their pinular outer ray is shorter and decidedly less spiny than that of the oscular pinule, but longer and more strongly developed than in the dermal pinule.

On the wall of the larger excurrent canals in the proximity of the oscular sieve-plate, as also on the inner side of the beams of this, there is a sparse and scattered occurrence of small pinule-like oxypentactins, the canalaria (pl. II, fig. 5). In these the unpaired ray, which projects freely into the canalar space, is 75—120 μ long and less than 5.5 μ thick at base; it bears, generally below the middle of its length, a small number — in some cases only 1—3 on a side — of short lateral spines not longer than 15 μ. All the other rays are entirely or nearly entirely smooth throughout; they are 40—72 μ long and less than 5 μ thick at base. Occasionally the spicule in question is in the form of simple-rayed oxypentactins, the spines on the unpaired ray having disappeared altogether. — Similar canalaria also occur isolatedly on the wall of the smaller and more deeply situated canals; but here they are on the whole much more weakly developed. The free unpaired ray seldom exceeds 40 μ in length, and the spines, born on it, are very small and few in number, there being only 2, 3 or 4 of them all told. Canalaria of this description apparently intergrade with the intermedial microhexactin to be described further on.

Of the fibres which compose the basal tuft, the coarser ones may be considerably over 150 mm. in total length. Such a large basalia is thickest — up to 200 μ thick — in the lowest third of its length, in which parts the shaft surface shows an interrupted spiral ridge with denticulate edge (pl. II, fig. 9). In the upper two-thirds of the length, the shaft is smooth and tapers gradually to the finely drawn out upper end. Towards the lower end too the thickness decreases to about 55 μ or less at a point, a short distance above the anchor, and at the same time the denticulate ridges give place to simple conical spines arranged in a spiral row (pl. II, fig. 8). Together with the above coarse fibres are found some much finer ones, generally not over 80 μ thick. (In specimen B all the basalia are fine, none of them exceeding 80 μ in thickness). In these fine basal fibres, as in all those small and adolescent ones still entirely contained in the columella, the denticulate ridge is undeveloped, there being only the spines in its stead. The terminal anchor, constantly found on all the young and still unprotruded

basalia but rarely preserved on those forming the external tuft, is 4-toothed, measuring 100—130 μ across from tip to tip of two opposite teeth. The teeth are short but strong, and of a conical shape; they may be 170 μ long, as measured along their inner side. The external outline of the entire anchor presents a Gothic-arch-line curvature. From the anchor upwards, the shaft remains spineless and smooth for a distance of about 0.5 mm.; it then begins to show the spines already mentioned. The spines commence to assume the form of denticulate ridges about 2 mm. from the anchor.

Some fine and spiny fibres, terminating at one end with a flattened bidentate anchor, were picked up from among the basal fibres of specimen A. In dimensions and general appearance they agreed completely with the lowest parts of the basal fibres of the *Pheronema giganteum* which was taken in the same haul of the trawl at the same station. I have entirely failed to discover fibres of the same character in the columella of the specimen, in which they may be expected to occur also, if they belonged to it. I therefore consider the bidentate-anchor fibres to be foreign spicules, derived in all probability from the *Pheronema* specimen referred to above.

The hypodermal latticework consists of beams made up of the paratangential rays of rather strong and nearly regular oxypentactins and of rhabdoxydiactins occurring in close association with the said paratangentials. The pentactins have entirely smooth rays. They are of a varying size. Their paratangentials often reach 1 mm., sometimes 1.5 mm. or over in length and nearly 100 μ thickness at base; the unpaired proximal ray is about as long as, or somewhat shorter than, the paratangential of the same spicule. The hypodermal rhabdodiactins are exactly comparable to those of the choanosome; only they remain generally under 3 mm. length and 80 μ thickness in the middle. — The sieve-plate beams lack the pentactin, being supported exclusively by rhabdodiactins similar to those of the hypodermal beams.

The supporting megascleres of the choanosome are smooth rhabdoxydiactins of various sizes. Hexactins of a sufficient size and strength to be counted under the megascleres, do not occur. Among the diactins there is a common occurrence of such as may be called the tignule (F. E. Sch. 1904, p. 65). This is bow-like, otherwise nearly straight, and may measure 10 mm. long by 300 μ thickness in the middle. The tignules, as also the smallest and thinnest of the ordinary rhabdodiactins, show but rarely subterminal roughness. Only in the diactins in the columella, in which they run as comitalia to the shafts of basal needles, the ends are commonly found to be more or less roughened on surface and to terminate with rounded or obtusely pointed tips. The central annular tyle is found only occasionally in limitation to the smaller of the rhabdodiactins of the entire body.

Mixed among the choanosomal rhabdodiactins is present the ambuncinate (pl. II, fig. 10), a peculiar kind of spined rhabdoxydiactins also found in *Compsocalyx* and certain species of *Hyalonema* (subgenera *Euhyalonema, Pteronema, Coscinonema*). It is met with here and there in isolated distribution, though I have found it not uncommon in the young specimen B. It may be 2 mm. or more long and 20 μ thick in the middle. The spicular centre is marked internally by the presence of the axial cross and externally by that of 2, 3 or 4 hook-like spines in a whorl, which are all short but still the longest of all the spines the spicule is armed with. The said spines at the spicular centre are bent sometimes all in the same direction, at

1. **Euhyalonema** n. subg.
2. **Pteronema** n. subg.
3. **Coscinonema** n. subg.
4. **Cyliconema** n. subg.
5. **Paradisconema** n. subg.
6. **Leptonema** v. Ldfld.
7. **Thamnonema** n. subg.
8. **Phialonema** v. Ldfld.
9. **Prionema** v. Ldfld.
10. **Corynonema** n. subg.
11. **Onconema** n. subg.
12. **Oonema** v. Ldfld.

It should here be added that a thoroughly satisfactory subdivision of the genus, free of all artificialness, seems scarcely possible under the present circumstances. The diagnoses and scopes of the subgenera may be given as follows:

1. **Euhyalonema,** n. subg. — Dermal pinular ray long, slender and whiplike, the short-spiny rhachis being thickest at base and over 250 μ, sometimes up to 600 μ or even 700 μ, long. Choanosomal megascleres entirely or nearly entirely rhabdodiactins, the macrohexactin being wanting or but very sparsely present. Ambuncinate always present. Microholactin apparently not present. Macramphidisc with umbel broader than long, $^1/_4$—$^1/_3$ as long as the entire spicule. Sponge with flat oscular sieve-plate in which open meshes occur in groups by imperforate tracts. — Type: *Hyalonema sieboldi* Gray.

Five species may be included in this subgenus:

H. intermedium n. sp.
H. keianum n. sp.
H. pellucidum Ij., 1894 (**1.**)
H. proximum F. E. Sch., 1904.
H. sieboldi J. E. Gray, 1835.

NOTES. — **1.** *H. pellucidum* was regarded by F. E. SCHULZE (1904, p. 159) to be a doubtful form, probably belonging to the range of *H. sieboldi.* In my view it is a well characterized form distinguishable from the latter. v. LENDENFELD (1915, p. 159) referred it to his subgenus *Phialanema,* but that is decidedly a mistake.

2. **Pteronema** n. subg. — Dermal pinular ray plumose or with moderately long lateral spines giving a conical or spindle-like shape to the entire ray; under 170 μ length; rhachis thickest at base. Choanosomal macrohexactin present or not present. Ambuncinate present. Microholactin hexactine, sometimes pentactine and stauractine. Macramphidisc as in *Euhyalonema.* Sponge with or without flat oscular sieve-plate. — Type: *Hyalonema topsenti* n. sp.

The following species may be brought together under this subgenus:

H. aculeatum F. E. Sch., 1894 (**1.**)
H. cebuense Higgin, 1875 (**2.**)
H. globus F. E. Sch., 1886 (**3.**)
H. heideri F. E. Sch., 1894 (**1.**)
H. topsenti, n. sp.
H. polycaulus v. Ldfld., 1915 (**4.**)

NOTES. — **1.** *H. aculeatum* and *H. heideri* have both been regarded by F. E. SCHULZE (1904, p. 159) as uncertain forms described from very young specimens. — **2.** Sieve-plate not known from this species, not improbably owing to its having been damaged in the type specimen. The species was relegated by F. E. SCHULZE (l. c.) to a doubtful form probably referable to *H. sieboldi,* but HIGGIN's description of it contains enough differential points which seem to justify holding it up as even subgenerically distinct from that species. — **3.** *H. globus* known from a young individual without an indication of a sieve-plate. — **4.** *H. polycaulus* described from a specimen which is possibly a teratological individual with more than one basal tuft. Sieve-plate not known from it, nor the ambuncinate. It is with considerable doubt that the species is added here to the list.

3. **Coscinonema** n. subg. — Dermal pinular ray whip-like with short lateral spines, or barely plumose with a little longer spines; rhachis thickest at base. Choanosomal macrohexactin generally present. Ambuncinate present. Microholactin hexactine. Macramphidisc generally similar

to that of *Euhyalonema* or *Pteronema*. Sponge with gastral depression showing a continuous sieve-like covering layer, which seldom may be flatly exposed as the oscular sieve-plate; the open meshes in all cases small and uniformly distributed. — Type: *Hyalonema kirkpatricki* n. sp.

Species referable to this subgenus are:

H. conus F. E. Sch., 1886.
H. heymonsi F. E. Sch., 1895 (1.)
H. indicum F. E. Sch., 1895.
H. kenti (O. Schm., 1880).
H. kirkpatricki n. sp.
H. lamella F. E. Sch., 1900.
H. pateriferum H. V. Wils, 1904 (2.)
H. schmidti F. E. Sch., 1899.
H. toxeres W. Thoms., 1877.

Further, *H. gracile* F. E. Sch., 1886, and *H. elegans* F. E. Sch., 1886, may probably be placed here, though the macramphidisc seems to be unknown from either.

NOTES. — **1.** *H. heymonsi* is possibly the young of *H. indicum*, as was given by F. E. SCHULZE (1904, p. 159). — **2.** In *H. pateriferum* the macramphidisc has unusually short and flattened umbels, on which account it was placed by V. LENDENFELD in his subgenus *Phialonema*.

4. **Cyliconema** n. subg. — Dermal pinular ray short-spiny and slender, in most cases under 250 μ length, or longer and whip-like; rhachis thickest at base. Choanosomal macrohexactin generally present, not known in some cases. Without ambuncinate. Microholactin hexactine. Macramphidisc usually like that of *Euhyalonema*; axial shaft may sometimes be untubercled and smooth; umbel broader than long, rarely shorter than $^1/_4$ or longer than $^1/_3$ the length of entire spicule. Sponge more or less cup-like, without an oscular sieve-plate or a gastral covering layer, so that excurrent canals open all freely into the gastral cavity or anyway on the gastral surface which may be, as it sometimes is, nearly externally exposed or even so entirely everted as to form a part of the external surface like the dermal. — Type: *Hyalonema apertum* F. E. Sch.

The species are:

H. apertum F. E. Sch., 1886 (1.)
H. coniforme F. E. Sch., 1904.
H. drygalskii F. E. Sch. & Kirkp., 1910.
H. globiferum F. E. Sch., 1904 (2.)
H. infundibulum Tops., 1896 (3.)
H. keiense, n. sp. (2.)
H. martabanense F. E. Sch., 1900.
H. molle F. E. Sch., 1904.
H. nicobaricum F. E. Sch., 1904 (4.)
H. ovatum Ij., 1895 (2.)
H. pirum F. E. Sch., 1895 (5.)
H. rapa F. E. Sch., 1900 (2.)
H. simile F. E. Sch., 1904.
H. somalicum F. E. Sch., 1904 (4.)
H. tenerum F. E. Sch., 1886 (6.)
H. thomsoni Marsh., 1875.
H. timorense, n. sp. (2.)
H. tulipa F. E. Sch., 1904.
H. valdiviae F. E. Sch., 1904.

NOTES. — **1.** Under *H. apertum* I include *H. maehrenthali* F. E. Sch., 1895, as a subspecies. — **2.** *H. globiferum, H. keiense; H. ovatum, H. rapa* and *H. timorense*, forms which seem to be especially nearly related to one another. — **3.** *H. infundibulum* Tops. regarded by TOPSENT (1904) himself to be perhaps only a variety of *H. thomsoni* Marsh. — **4.** *H. nicobaricum* and *H. somalicum*, doubtful if these can be held up specifically distinct. — **5.** *H. pirum*, regarded by F. E. SCHULZE (1904, p. 159) as a species *dubia*, perhaps representing a young stage of *H.* (*Coscinonema*) *indicum*. — **6.** *H. tenerum*, an insufficiently known species regarded by V. LENDENFELD (1915, p. 151) to be receivable into his *Oonema*; but its long whip-like dermal pinule makes me inclined to place it rather under *Cyliconema*.

5. **Paradisconema** n. subg. — Distinguished from all the other subgenera by the presence of the so-called paradisc (F. E. SCHULZE, 1895, p. 37) which seems to be a peculiar modification of the micramphidisc. In other points of spiculation and in the habitus of the sponge essentially like *Coscinonema* or *Cyliconema*; with or without oscular sieve-plate. — Type: *Hyalonema alcocki* F. E. Sch., 1895.

Besides the type, *H. investigatoris* F. E. Sch., 1895, and *H. vosmaeri* n. sp. come under this subgenus. The former was later placed by the describer (1904, p. 159) among the doubtful species as being not sufficiently characterized.

6. **Leptonema** v. Ldfld, 1915. — Dermal pinular ray short-spiny and whip-like, up to 800 μ long; or shorter (up to 300 μ long) and either short-spiny or moderately long-spiny and narrowly plumose in appearance; rhachis thickest at base. Choanosomal macrohexactin and intermedial microhexactin generally present. Without ambuncinate. Largest macramphidisc relatively narrow, with umbel longer than broad. Sponge with or without oscular sieve-plate or a covering layer to sunken gastral surface. — Type: *Hyalonema campanula* v. Ldfld.

The species are:

H. acuferum F. E. Sch., 1893.
H. campanula v. Ldfld., 1915.
H. divergens F. E. Sch., 1886.
H. flagelliferum, n. sp.
H. lusitanicum B. de Boc., 1864.
H. ovuliferum F. E. Sch., 1899.
H. solutum F. E. Sch., 1904.
H. urna F. E. Sch., 1904.

7. **Thamnonema** n. subg. — Dermal pinular ray with some lateral spines unusually prolonged (40 μ or over) and giving to the entire ray an appearance somewhat like that of a bush with long unbranched twigs. Macramphidisc relatively narrow, with deeply bell-like umbels, longer than broad.

With the single species *Hyalonema thamnophorum* n. sp., known from a single, apparently very young specimen.

8. **Phialonema** v. Ldfld., 1915. — Dermal pinular ray nearly as in *Thamnonema*, but some of the lateral spines bearing secondary spines. Macramphidisc broad, with flattened and relatively very short umbels.

With the single species *Hyalonema brevancora* v. Ldfld., 1915, known from a fragment. Besides that species, v. LENDENFELD (1915) has referred to this subgenus *H. pateriferum* Wils. and *H. pellucidum* Ij. The former I consider had better be transferred into *Coscinonema*, while the latter should decidedly be grouped together with *H. sieboldi* under *Euhyalonema*.

9. **Prionema** v. Ldfld., 1915. — Dermal pinular ray varying in general shape from swollen and spindle-like to slender with tapering rhachis. The largest or the second largest kind of amphidisc with umbel teeth which are finely serrated or fimbriated on their lateral edges. — Type: *Hyalonema agujanum* v. Ldfld.

The scope of the subgenus remains exactly the same as given it by v. LENDENFELD. The species are:

H. agujanum v. Ldfld., 1915.
H. azuerone v. Ldfld., 1915.
H. crassum v. Ldfld., 1915.
H. fimbriatum v. Ldfld., 1915.
H. pinulifusum v. Ldfld., 1915.
H. poculum F. E. Sch., 1886 (1.)
H. spinosum v. Ldfld., 1915.
H. validum F. E. Sch., 1904.

NOTES. — **1.** *H. poculum*, included by v. LENDENFELD, (l. c., p. 152) among his *Leptonema*, apparently by an error.

10. **Corynonema** n. subg. — Dermal pinular ray, together with its strongly developed lateral spines, shaped elongate-spindle-like or club-like, more or less bushy; rhachis distinctly swollen in the middle parts or toward the upper end and terminating with apical cone. Choanosomal macrohexactin and intermedial microhexactin always present. Without ambuncinate or the uncinate rhabdodiactin peculiar to *Onconema*. Macramphidisc approximately as in *Euhyalonema*; the umbel sometimes slightly longer than $^1/_3$ the whole length of the spicule. Sponge of a habitus and structure essentially like Cyliconema; rarely with oscular sieve-plate. —

Type: *Hyalonema owstoni* Ij.

The following species may be listed under this subgenus, though it is likely that not a few of them will prove in the future to be untenable as distinct species:

H. calix F. E. Sch., 1904.
H. clathratum Ij., 1894.
H. clavigerum F. E. Sch. 1886.
H. cupressigerum F. E. Sch. 1893.
H. depressum F. E. Sch., 1886, included by v. LENDENFELD (1915, p. 152) among his *Leptonema*.
H. grandancora v. Ldfld., 1915.
H. hercules F. E. Sch., 1899.
H. masoni F. E. Sch., 1895.
H. owstoni Ij., 1894.
H. placuna v. Ldfld., 1915.
H. populiferum F. E. Sch., 1899.
H. rotundum n. sp.
H. tenuifusum v. Ldfld., 1915.
H. tylostylum v. Ldfld., 1915.
H. weltneri F. E. Sch., 1895.

11. **Onconema** n. subg. — Like *Corynonema* in nearly all respects, but distinguished from it by an abundant presence, in the peripheral parts of body, of uncinate rhabdoxydiactins ("uncinate amphiox" or "diactin uncinate" v. LENDENFELD's).

Containing the two species, *Hyalonema obtusum* v. Ldfld., 1915, and *H. agassizi* v. Ldfld., 1915. The specific distinctness of the two forms may be doubted.

12. **Oonema** v. Ldfld., 1915. — Dermal pinular ray, together with its strongly developed spines, shaped spindle-like or elongate-spindle-like; the rhachis distinctly swollen in the middle parts, terminating with apical cone. The only kind of macramphidisc present or the second smaller kind of same is broadly ovoid in shape, with more or less semispherical-like umbels which are nearly 0.5 as long as, or at any rate distinctly longer than $^1/_3$, the length of the whole spicule. The larger macramphidisc kind, if present, either somewhat like the smaller kind in shape or of a considerably different shape. —

Type: *Hyalonema bianchoratum* H. V. Wils.

Comprising the following species:

H. aequatoriale v. Ldfld., 1915 (**1.**)
H. bianchoratum Wils., 1904.
H. crassipinulum v. Ldfld., 1915 (**2.**)
H. densum v. Ldfld., 1915 (**3.**)
H. geminatum v. Ldfld., 1915 (**4.**)
H. henshawi v. Ldfld., 1915 (**3.**)
H. pedunculatum Wils., 1904 (**5.**)
H. robustum F. E. Sch., 1886 (**5.**)
H. sequoia v. Ldfld., 1915 (**2.**)
H. umbraculum v. Ldfld., 1915 (**1.**)

NOTES. — **1.** *H. aequatoriale* and *H. umbraculum* were made by v. LENDENFELD to constitute his subgenus *Skianema*. In my opinion, the two forms, besides being probably specifically identical between them, can scarcely be regarded to be more than specifically distinct from *H.* (*Oonema*) *bianchoratum*. Hence, *Skianema* merges in *Oonema*. — **2.** *H. geminatum*, the single species for which v. LENDENFELD has erected his subgenus *Thallonema*, is, in my estimation, possibly even specifically identical with either or both of the above two species referred by him to *Skianema*. Hence, *Thallonema* becomes, through *Skianema*, unitable with *Oonema*. — **3.** *H. crassipinulum* and *H. sequoia*, possibly specifically inseparable. — **4.** *H. densum* and *H. henshawi*, ditto. — **5.** *H. pedunculatum* and *H. robustum*, ditto.

Key to the subgenera of *Hyalonema*.

A. Macramphidiscs, either all or the smaller kind of them, with serrated or fimbriated lateral edges to umbel teeth . . . . **Prionema** v. Ldfld. (9).

B. All macramphidiscs with smooth-edged umbel teeth.

a^1. Dermal pinular ray with rhachis thickest at base and tapering towards tip.

a^2. Macramphidisc relatively narrow, with umbels longer than broad.

a^3. Dermal pinular ray either short-spiny and whip-like or moderately long-spiny and narrowly plumose . . . . **Leptonema** v. Ldfld. (6).

b^3. Dermal pinular ray with unusually prolonged spines, appearing like a bush with long unbranched twigs . . **Thamnonema** n. subg. (7).

b^2. Macramphidisc with umbels broader than long.

c^3. Dermal pinular ray with unusually prolonged spines as in b^3, but having macramphidisc with flattened and relatively very short umbels. . . . . **Phialonema** v. Ldfld. (8).

d^3. Dermal pinular ray short-spiny and whip-like, or moderately long-spiny and more or less plumose. Macramphidisc with umbels, usually $^1/_4$—$^1/_3$ as long as the length of the whole spicule, exceptionally very short and flattened.

a^4. With paradisc . . . . . **Paradisconema** n. subg. (5).

b^4. Without paradisc.

a^5. Without ambuncinate. (Dermal pinular ray short-spiny. Without oscular sieve-plate or a covering layer over gastral surface). . . . . **Cyliconema** n. subg. (4).

b^5. With ambuncinate.

a^6. Dermal pinular ray moderately long-spiny and distinctly plumose, conical or spindle-like in general shape. With or without oscular sieve-plate. . . **Pteronema** n. subg. (2).

b^6. Dermal pinular ray short-spiny and whip-like or barely plumose.

a^7. With covering layer over depressed gastral surface or a flat oscular sieve-plate showing small and uniformly distributed open meshes . . . **Coscinonema** n. subg. (3).

b^7. With flat oscular sieve-plate showing open meshes assembled in groups separated by imperforate tracts . . . . . **Euhyalonema** n. subg. (1).

b^1. Dermal pinular ray with rhachis distinctly swollen in the middle parts or towards the end, terminating in an apical cone.

c^2. Uncinate rhabdoxydiactin numerously present in the periphery of body . . . . . **Onconema** n. subg. (11).

d^2. Without the above diactin.

e^8. Macramphidiscs, all or in part, broadly ovoid and with umbels nearly $^1/_2$ as long as, or at any rate distinctly longer than $^1/_3$, the length of the whole spicule . . . **Oonema** v. Ldfld. (12).

f^8. Macramphidisc narrower, with umbels generally $^1/_4$—$^1/_3$ as long as the length of the whole spicule . . . . . **Corynonema** n. subg. (10).

Of the Hyalonemas collected by the "Siboga" there are eight subgenera and eleven species, as follows:

1. *H.* (*Euhyalonema*) *intermedium* n. sp.
2. *H.* (*Euhyalonema*) *keianum* n. sp.
3. *H.* (*Pteronema*) *topsenti* n. sp.
4. *H.* (*Coscinonema*) *kirkpatricki* n. sp.
5. *H.* (*Cyliconema*) *apertum maehrenthali* n. subsp.
6. *H.* (*Cyliconema*) *timorense* n. sp.
7. *H.* (*Cyliconema*) *keiense* n. sp.
8. *H.* (*Paradisconema*) *vosmaeri* n. sp.
9. *H.* (*Leptonema*) *flagelliferum* n. sp.
10. *H.* (*Thamnonema*) *thamnophorum* n. sp.
11. *H.* (*Corynonema*) *rotundum* n. sp.

1. *Hyalonema* (*Euhyalonema*) *intermedium*, n. sp. Plate I, figs. 1, 2. Textfig. 4.

Stat. 262. 5° 53′.8 S., 132° 48′.8 E. 560 m. 1 specimen.

Diagnosis. — Like *Hyalonema sieboldi* Gray in general shape, but differing from it in the somewhat more strongly developed dermal latticework; in the much less distinct grouping of the open meshes of oscular sieve-plate into several assemblages; in the pinules of sieve-plate being longer (over 400 μ, up to 700 μ or even 820 μ long); in the pinular ray of same being on the whole longer and more strongly developed than that of the dermal pinule; in the ambuncinate being mostly much longer (1—2 mm. or over in length) and more sparsely barbed; in the macramphidisc being larger (430—485 μ long) and having hyperbolical, instead of semispherical or semiovoid, umbels; and in the absence of the mesamphidisc.

Description. — From Stat. 262, among the Kei Islands, comes the single large but incomplete specimen (pl. I, figs. 1, 2), which is made the type of this new species. It consists of a large part of the sponge body, from which a portion including the basal tuft has been torn off and lost. So far as they go, the parts are well preserved. The entire body

must have been of the shape of a sculptor's mallet, 127 mm. long and 114 mm. broad. It is truncate above and rounded below. The surface of the oscular sieve-plate is uneven. Its central parts, which do not show a projecting gastral cone, are irregularly depressed to a depth of about 24 mm. from the level of the rim. The marginal cuff exists in small remnants; it must have been at places fully 4 mm. wide and fringed with an inconspicuous row of marginalia. The central parts of the basal end of body, where is preserved a portion of the basal pad or the compact tissue surrounding the point of origin of the basal tuft, are not depressed.

The dermal surface (pl. I, fig. 2) is moderately even. Compared with average specimens of *H. sieboldi* from Sagami Sea, the dermal layer differs considerably in appearance; in that the hypodermal beams are appreciably stronger, being at places nearly 0.5 mm. thick; in the same running somewhat more definitely transversally and longitudinally; and in the soft dermal membrane consisting of somewhat broader trabeculae, which, together with the numerous pores (up to $^1/_3$ mm. in diametre) they inclose, are distinctly visible with the naked eye. In short, the dermal layer appears to a degree less delicately structured, and in most places to be somewhat more regularly checkered-like and quadrangular-meshed, than in *H. sieboldi*. The meshes of the hypodermal latticework generally measure 1—1.5 mm. in the length of sides.

The open meshes of the oscular sieve-plate are comparatively large — about as large as in *H. sieboldi* — measuring generally 3—5 mm. across. They are in shape mostly roundish, oval or triangular with rounded corners. The beams, separating them from one another, are ordinarily thin though on the whole stronger than in average specimens of *H. sieboldi*. Through the open meshes of the sieve-plate are seen a number of wide but variously sized openings of main excurrent canals. Three of these are situated centrally around the columella, and thirteen or fourteen more in a circle in the more peripheral parts. As usual, where the septal edges between all these canalar openings stand in connection with the inner surface of the sieve-plate, there exist in the latter irregular patches and tracts of a nearly continuous surface, showing small and inconspicuous apertures in an indefinite distribution. These areas divide the open meshes of the open meshes of the sieve-plate into ill-defined assemblages, covering over each wide opening of the main excurrent canals, but the division is by no means so well marked as in most individuals of *H. sieboldi*.

Spiculation. — The spiculation is essentially the same as in *H. sieboldi*, though differing in points of detail concerning many kinds of the spicules.

The dermal pinule (textfig. 4, *a*) may be said to be of quite the same appearance and dimensions as that of the species just referred to. The whip-like, short-spiny free ray is generally 400—700 μ (rarely 312 μ, sometimes 721 μ) long and 9—11 μ thick at base. The basal rays are 40—50 μ long as measured from the spicular centre and about 8 μ thick at base.

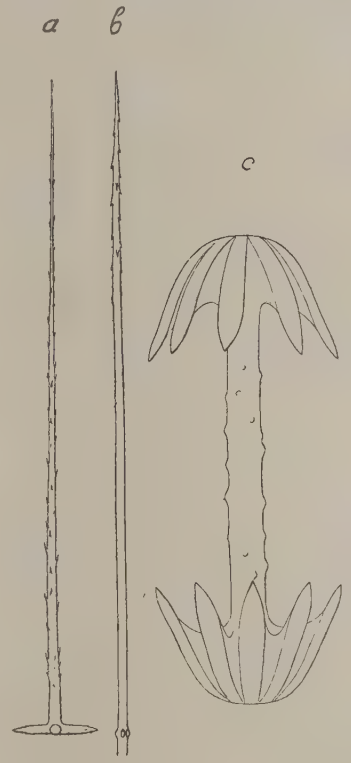
The oscular or gastral pinule presents much the same character as the dermal. The free ray is generally over 400 μ long, reaching up to 700 μ and sometimes even 820 μ; it may be 13 μ thick at base. The basal rays are about 44 μ long by a thickness of 10—13 μ at base. A large proportion of gastral pinules is longer and somewhat more robustly developed than the majority of dermal pinules. In fact, the former shows on the whole a stronger development than the latter, a relation which is the converse of that which obtains in *H. sieboldi*.

The marginalia are rhabdoxydiactins, in which the centre is marked with four tubercles

and the distal free ray is short-spiny, like that of dermal or gastral pinules. They may be 1 mm. or over in total length.

Pinule-like pentactine canalaria occur but very rarely on the wall of both incurrent and excurrent canals. In a few cases which were measured, the free unpaired ray, provided with a limited number of obliquely distally directed spines, was 110—143 μ long, while the much more weakly spiny basal rays were 55—99 μ long.

Hypodermal oxypentactins may have paratangential rays 1.3 mm. long and 65 μ thick at base. Hypodermal rhabdodiactins, which, together with the above named paratangentials, make up dermal lattice beams, are of various dimensions, up to 40 μ thick in the middle. They are without the central tyle and taper towards both ends which are obtusely pointed. In both the kinds of hypodermalia the rays are quite smooth without subterminal roughness or with only a faint indication of it. — The oscular sieve-plate is wanting in pentactine supports, it being supported solely by rhabdodiactins which differ in no way from those of the dermal layer.



Textfig. 4. — *Hyalonema intermedium* n. sp. *a*, dermal pinule. *b*, ambuncinate; a greater part of one ray omitted. Spicular centre near the lower end of the figure. *c*, macramphidisc. All figures × 150.

The supporting spicules of the choanosome are exclusively rhabdodiactins. Some of these are tignules up to 9 mm. long and 300 μ thick in the middle, smooth all over and bluntly pointed at both ends. Others of them are much thinner, being mostly 1.5—5 mm. long and 15—27 μ thick. They are generally obtusely pointed, sometimes rounded at ends and without or with but an indication of subterminal roughness. All the rhabdodiactins do no exhibit the central tyle. Neither macrohexactins nor microhexactins occur in the choanosome.

A special kind of choanosomal rhabdodiactins is the ambuncinate (textfig. 4, *b*) with tapering rays, provided with retroverted spinules or barbs. This spicule occurs not uncommonly among the ordinary rhabdodiactins of the choanosome as well as of the oscular sieve-plate. It is mostly 1—2 mm. long by a thickness of 5—8 μ; rarely somewhat longer than 2 mm. and 15 μ thick, or so short as to measure only 600 μ in length. The majority of the spicules are considerably larger than in *H. sieboldi*, in which the length does not exceed 900 μ. Moreover, the barbation is somewhat more poorly developed. The barbs are generally confined in their occurrence to within the distal half of each ray and are set with rather wide intervals (30 μ or more) between them. Besides, they are so small that it generally requires a high power of the microscope to recognize the ambuncinate. The spicular centre may be externally marked with a whorl of knob-like tubercles; more often it is devoid of any such external marking. It may be said that the ambuncinate of this species is in a state, relatively but little differentiated from ordinary rhabdodiactins of the choanosome. Three-or four-rayed ambuncinates, mentioned by F. E. Schulze from *H. proximum*, were not discovered.

The macramphidisc (textfig. 4, *c*) is common in the dermal layer, and commoner still

in the oscular sieve-plate. It is over 400 μ, most commonly 430—485 μ, long. The umbel is well rounded at the pole and expands towards the rim, so that its outline in lateral view may be described as hyperbolical. Its length is about 120 μ and always shorter than one-third the length of the whole spicule, being often of about one-fourth the latter length. The breadth at the rim is generally 150—175 μ. The umbel teeth number 8; they are moderately broad and obtusely pointed at tip. The axial shaft is strong, usually measuring 27—30 μ in thickness. It shows a number of low conical tubercles, irregularly scattered on the surface; only seldom are some of these arranged in a whorl around the spicular centre. The macramphidisc, in comparison with that of *H. sieboldi*, is larger; the umbel more expanded, and the shaft stronger.

Mesamphidiscs were not found.

Micramphidiscs of the usual character are common in all parts of the sponge. They are 15—23 μ, rarely up to 27 μ, long. The umbel is generally about $^1/_3$ the length of the whole spicule.

Remarks. — Closely similar to *H. sieboldi*, as this species appears to be, it seemed to me justifiable to make a distinction between the two in view of some tangible differences in the character of certain spicules, taken in combination with the remoteness of their localities. Another species which seems to differ but little from the present is F. E. Schulze's *H. proximum* from off the western coast of Sumatra. The principal differential points, as far as can be gleaned, of the three species referred to may be tabulated as follows:

	H. intermedium	*H. proximum*	*H. sieboldi*
Dermal pinule	Generally 400—700 μ long.	300 μ long on an average.	About the same length as in *H. intermedium*.
Sieve-plate pinule	On the whole somewhat longer than dermal pinules	Similar to dermal pinules.	On the whole much shorter than dermal pinules.
Choanosomal Macroxyhexactin	Not present.	Present in various size.	Not always present.
Ambuncinate.	1—2 mm. long, or longer.	1—2 mm. long, or longer.	Not longer than 900 μ.
Macramphidisc.	430—485 μ long.	300 μ long.	Not longer than 440 μ, generally shorter than 400 μ.
Mesamphidisc	Not present.	Not present.	Present.

Possibly, with advance in the knowledge, the three forms will be shown to be not separable specifically, the differences indicated being perhaps of not more than subspecific or varietal value.

2. *Hyalonema (Euhyalonema) keianum* n. sp. Plate I, figs. 3, 4. Textfig. 5.

Stat. 254. 5°40′ S., 132°26′ E. 310 m. 2 specimens.

Diagnosis. — Body inverted-conical, rounded below; with oscular sieve-plate perforated by numerous apertures which are characteristically small, being on an average only 1 mm. wide (or not wider than 2 mm.), and which are distributed in ill-defined groups separated by irregular

imperforate tracts of varying extent. Spiculation essentially as in *H. intermedium*. Dermal pinule 240—500 μ (or 440—700 μ) long. Pinule of sieve-plate about as long, but somewhat more robustly developed. Tignule not longer than 5 mm. Ambuncinate 0.5—2 mm. long, common. Neither macrohexactin nor microhexactin present among choanosomal spicules. Macramphidisc 300—430 μ (or 385—460 μ) long, with umbels of hyperbolical outline in lateral view. Mesamphidisc may not be present; if present, under 45 μ length, ovoidal in shape, with umbels considerably longer than $^1/_3$ the length of whole spicule. Micramphidisc of the usual shape and size, with umbels about $^1/_3$ as long as the whole spicule, found in abundance.

Description. — This species is based on two moderately large specimens, A and B, which were obtained at the "Siboga" Station 254, among the Kei Islands. Specimen A is shown in pl. I, figs. 3 and 4. Both the specimens are of an inverted-conical shape and about 100 mm. high; they are rounded at the lower end, which is 40—50 mm. broad, and truncate at the upper end which is 100 mm. broad in A and 83 mm. in B. The oscular sieve-plate of the former is nearly flat, that of the latter uneven and depressed in the central parts to a depth of about 20 mm. from the general level of the margin. In neither specimen there exists a gastral cone. The oscular margin is sharp-edged and furnished with a fringe of quite inconspicuous marginalia.

The intersecting hypodermal strands of the dermal layer are distinctly visible as long, continuous threads, which are rather coarse, attaining at places a thickness of $^1/_3$ mm. In specimen A they run in most parts in more or less oblique directions (pl. I, fig. 4), while in specimen B they are more or less inclined to being transverse and longitudinal, thus bringing about a latticework which is quadrangular-meshed to a large extent.

The appearance of the oscular sieve-plate (pl. I, fig. 3) is strikingly different from that of either *H. sieboldi* or *H. infundibulum*, chiefly owing to the smallness and numerousness of the open meshes. In A these are on an average only about 1 mm. wide; in B they are on the whole somewhat larger, frequently reaching a width of nearly 2 mm. but not more. Imperforate and granular-looking patches and tracts of no definite extent or configuration occur in the sieve-plate and divide the open mesh apertures into ill-defined assemblages.

Excurrent canalar openings visible beneath the sieve-plate are, in A, relatively small (up to 10 mm. across) and fairly numerous. In B they are found to be larger and much less numerous, the manner of their arrangement being here approximately the same as in *H. sieboldi*.

Spiculation. — The following description of the spicules applies to specimen A, unless specially stated as referring to specimen B or to both.

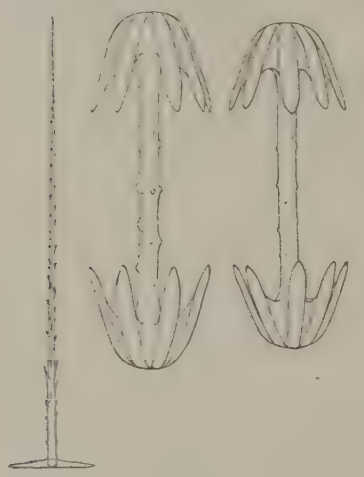
The dermal pinule (textfig. 5, *a*) is long, slender and short-spiny as in all members of the subgenus. Length of the free ray 240—420 μ, sometimes even 500 μ; its thickness at base 8 μ. Length of basal rays 40 μ, as measured from the spicular centre. The shorter pinules, of say 240—300 μ length, seemed to be confined in occurrence to the surface of the narrower trabeculae of the dermal membrane. In B I have found the dermal pinules to be on the whole much longer and more slender, the rhachis measuring 440—700 μ long and up to 7.5 in basal thickness.

Pinules of the oscular sieve-plate are 440—550 μ or more long, the longer ones being usually found broken off at the outer end. The rhachis is 10—15 μ (in B not over 12 μ) thick at base and therefore somewhat stronger than that of the dermal pinule. Basal rays 55—75 μ (in B 35—50 μ) long as measured from the spicular centre.

The marginalia are diactine pinules of the usual appearance. The distal spiny ray is 700 μ long or longer; the proximal ray is smooth and shorter.

Canalar pinules are occasionally met with. They are like the dermal pinule, but are much more weakly developed, the free ray measuring 100—200 μ in length.

Pentactine and rhabdodiactine megascleres of the hypodermal framework, as well as the rhabdodiactine megascleres of both the sieve-plate and the choanosome, seem to require no special description, as they all show essentially the same character and arrangement as in *H. intermedium*. The bow-like or nearly straight tignules, occurring in the choanosome, are relatively small, measuring not over 5 mm. in length and 220 μ in thickness at the middle.



Textfig. 5. — *Hyalonema* (*Euhyalonema*) *keianum* n. sp. *a*, dermal pinule of about maximum size. *b*, macramphidisc from dermal layer. *c*, another macramphidisc from oscular sieve-plate. All figures × 50.

The ambuncinates are of common occurrence in both the sieve-plate and the choanosome. In length they range from 0.5 mm. to nearly 2 mm., with a thickness of 4—10 μ near the middle, but are mostly 700—1000 μ long by about 7 μ thickness. The spicular centre is externally marked by an indistinct annular swelling or by a pair or two pairs of rounded tubercles. The retroverted spines, short and barb-like, are found on the distal half or on about distal three-fourth of the length of each ray.

Neither macrohexactin nor microhexactin occurs in the entire skeleton.

The acanthophores, forming a compact basal pad around the exit point of the basal tuft, are closely similar to those of other species of the subgenus and seem to offer no point of particular use in the systematic. Basal needles are entirely wanting in both the specimens.

The macramphidiscs (textfig. 5, *b*, *c*) are common in the dermal layer and quite numerous in the sieve-plate. They are generally 300—374 μ, rarely 430 μ, long (in B 385—460 μ). The umbel in lateral view is hyperbolical or semioval (in B frequently nearly semicircular) in outline; generally with 8, moderately broad teeth, either rounded or obtusely pointed at tip. The shaft is in both the specimens 15—20 μ thick, with small rounded tubercles irregularly scattered on the surface. An indefinite number of the tubercles may sometimes form a whorl around the spicular centre. Measurements of some representative macramphidiscs as follows:

Macramphidisc from Specimen A.			Macramphidisc from Specimen B.		
Total length in μ	Length of umbel in μ	Breadth of umbel at rim in μ	Total length in μ	Length of umbel in μ	Breadth of umbel at rim in μ
300	88	100	385	88	130
308	99	110	390	88	120
330	110	99	400	100	130
330	100	110	420	80	130
341	100	120	450	120	145
430	110	154	460	100	130

As the mesamphidisc I regard the little amphidiscs met with occasionally, which may be 45 μ long and 23 μ broad, or less in dimensions, and which are characterized by having an ovoid or barrel-like shape, the opposite umbels approaching each other more or less closely with the ends of their teeth. The teeth are slender, numbering about 10 to each umbel. The shaft is smooth, but usually shows a node-like swelling in the middle.

The above named mesamphidisc seems to grade over into the micramphidisc. This is found in great abundance in the dermal layer and the oscular sieve-plate. Ordinarily it measures 20—15 μ in length and 4—7.5 μ in breadth, and is of the usual shape, the umbel consisting of slender teeth, 12 or more in number, and being as a rule of about $^1/_3$ the length of the whole spicule. The shaft is nearly smooth or obsoletely rough, and usually without, but sometimes with, a node-like swelling in the middle.

In specimen B I have not found the mesamphidisc, though the micramphidisc of much the same appearance as that of specimen A is common. The micramphidisc here reaches a length of 27 μ.

Remarks. — With respect to spiculation it must be said that no important difference can be pointed out between this species and *H. intermedium*. However, there exists a striking difference between them in the macroscopic appearance of the oscular sieve-plate, as will at once be noticed by comparing fig. 3 and fig. 1 in plate I. The same also holds true in comparison with either *H. sieboldi* or *H. proximum*. The open meshes of the sieve-plate in the keian form of *Euhyalonema* are characteristically small and numerously present. It is chiefly on this account that I have made it a distinct species.

In outward appearance of the body, including that of the sieve-plate, *H.* (*Euhyalonema*) *keianum* resembles *Chalaronema sibogae* n. sp. (also from the Kei Islands) to such a degree that the two might easely be thrown together; but an examination of superficial pinules alone, so strikingly different in appearance in the two forms, should suffice to distinguish them at once.

3. *Hyalonema* (*Pteronema*) *topsenti*, n. sp. Plate I, figs. 5, 6. Plate II, fig. 11. Plate III, figs. 1—10.

Stat. 145. 0° 54′ S., 128° 39′.9 E. 827 m. 2 specimens.
Stat. 254. 5° 40′ S., 132° 26′ E. 310 m. 1 specimen.

Diagnosis. — Body shaped somewhat like a sculptor's mallet, with flat oscular sieve-plate at the upper end. Pinules with the pinular ray strongly spiny and fir-tree-like or plumose; those of dermal surface 130—154 μ long; those of sieve-plate usually 450—550 μ long; those of main internal canals generally 150—230 μ long, sparsely spiny. Basalia with 7- or 8-toothed anchor; the shaft with spiral series of strong conical spines. Choanosomal supporting spicules rhabdoxydiactins, of which the tignules may be 9 mm. long and 200 μ thick in the middle. Ambuncinate 2 mm. or over in length, sparsely barbed near end; not numerous. Macrohexactin not present. Intermedial microhexactin slim-rayed, smooth or nearly smooth, 60—120 μ in ray length. Macramphidisc 440—500 μ (or 350—420 μ) long; the umbel hyperbolical, with or without gentle outflaring of sides, 8-toothed, 145—175 μ broad, 110—145 μ long, about $^1/_3$ the length of the whole spicule or somewhat shorter; the teeth rounded or pointed at tip; the shaft

generally smooth, with a whorl of tubercles in the middle. Without mesamphidisc. Micramphidisc of the usual character, not abundant.

Description. — At Stat. 145 in Halmaheira Sea, east of the Moluccan island Halmaheira (or Djilolo), were obtained the two specimens (A and B) of this new species, which I have named in honour of the distinguished spongologist of Caen, Professor E. Topsent. Both are imperfect, and the better preserved — specimen A — of the two has chiefly served as the object of my investigation. A third specimen, C, which was obtained at Stat. 254, among the Kei Islands, is referred to the same species with doubt.

Specimen A (pl. III, figs. 1, 2), which is made the type of the species, consists of two moderately large hemispherical masses which were apparently parts of one and the same individual, and of the basal tuft completely severed from the body. The entire sponge body in the original state may be assumed to have been of a spheroidal shape, 120 mm. or thereabout in both height and transverse diametre. A flat sieve-plate, of which only a small portion is left, should have covered the upper polar area, while from the slightly depressed lower pole there should have projected the root-tuft to a length of 250 mm. or more. The root-tuft, about 6 mm. thick near its exit from the body and composed of fibres nearly half a millimetre thick, is spirally twisted in the usual direction and frayed out in the lower parts. In short, the appearance of the entire sponge must have differed but little from that presented by some individuals of *H. sieboldi.*

The oscular sieve-plate is perforated by oval, roundish or roundly polygonal, open meshes of 1—2 mm. width and on the whole somewhat smaller than those of *H. sieboldi.* Certain beams of the plate around the close assemblages of open meshes in varying numbers may be over 1 mm. broad; for the rest the beams are much thinner. From the fragmentary condition of the plate it cannot be ascertained if in the entire state there existed in it imperforate tracts of any extent, such as we are familiar with in the sieve-plate of many Euhyalonemas. If I have not erred in referring specimen C (pl. I, fig. 5) to the species, the state of the sieve-plate in that specimen may be taken as indicating the absence of imperforate tracts in the sieve-plate of the species.

The dermal layer, again only partially preserved, consists of an approximately quadrate-meshed hypodermal latticework, on the beams of which stand dermal pinules in a row or rows. The lattice beams are not of a uniform strength: the thicker ones, by intersecting one another, form small rectangular meshes, each of which is usually subdivided by much thinner beam or beams into two or more elementary meshes, also rectangular in shape and about 1 mm. or less in the length of sides. Towards the basal pole, the dermal pinules become more and more crowded, finally filling up the otherwise more or less open meshes; so that, the dermal surface in the lowest parts presents a continuously granular appearance.

Directly beneath the sieve-plate are seen large apertures of very wide subcentral canals, 4 or 5 in number and separated by broad septa, radiating from the axial parts occupied by the columella.

The entire choanosome is of a soft, light and cavernous texture, and when seen on the lacerated outside, appears like a loose mass of thin and crisp spicular fascicles.

The second specimen, B, is a very much more imperfect one, consisting, as it does, of only the basal tuft, to which is attached a small remnant of body tissues. Of the basal tuft, the columellar part is about 70 mm. long; the free part is about as long or a little longer, and about 7 mm. thick at the point of exit from the basal pad. The tuft is compact but does

not show the usual twisting, indicating the immaturity of the individual. From the spiculation, as determined from the tissues attached to the columellar part, there can be no doubt whatever of the specific identity of the specimen with the first described from the same station.

Specimen C (pl. I, figs. 5, 6) from Stat. 254 is, as before mentioned, referred to this genus and species with much reserve; for, it may possibly belong to another Hyalonematid, *Chalaronema sibogae*, which I hold to be even generically separable from *Hyalonema*. A decision on the point might be possible, had the specimen preserved the basal tuft, which it unfortunately did not; the main distinctive criterion between the two forms lying in the character of that tuft (see p. 49). We have here to do with a large fragment which represents nearly, but not quite, one vertical half of the sponge body. The body, when entire, must have been of a somewhat inverted-conical shape, flatly truncate at the superior end and rounded at the contracted inferior end. Height of body 89 mm.; its greatest breadth not less than 63 mm. The oscular area, occupied by the flat sieve-plate, must have been 51 mm. or more in diametre. It is bounded, probably all around in the entire state of the sponge, by a horizontally directed and sharp-edged marginal cuff of an inconspicuous width. So far as it goes, the fragment is in a good state of preservation. It is of a rather firm consistency. The dermal surface (fig. 6) exhibits a quadrangular-meshed and somewhat coarse-looking latticework, formed by hypodermal strands of varying thickness. Certain strands of the two intersecting systems are considerably thicker than others, much as in the type specimen. The meshes measure mostly 0.5—1 mm. in width. In the wet state of the specimen the hypodermal latticework is distinctly visible all over the surface; but when dried, the layer of densely set dermal pinules assumes the appearance of an intransparent and nearly continuously granular coating, which conceals the structure below, except of course at places where it has fallen off as the result of laceration. The oscular sieve-plate (fig. 5) is relatively strongly beamed. As in the type specimen again, certain of the beams are considerably broader than others, though imperforate tracts separating the open meshes into distinct groups do no exist. The fairly uniformly distributed meshes measure mostly about 1 mm. across; they are therefore on the whole somewhat smaller than in the type in which they are 1—2 mm. wide.

Spiculation. — First let the spiculation of the type specimen (A) be described. (Pl. III, figs. 1—10). The manner of arrangement of the various spicules may be said to be practically the same as in *H. sieboldi*.

The dermal pinules (pl. III, fig. 3) have plumose pinular rays provided with numerous well-developed lateral spines. The entire ray is 130—154 μ long and about 44 μ broad in the broadest part which lies below the middle of the height. Its rhachis, about 8 μ thick at base, is not thicker above in the spiny parts, or is just perceptibly thickened in that parts. It is sharply pointed at tip of the elongate-conical end which projects free a short distance beyond the ends of uppermost spines. Lateral spines begin to exist on rhachis a short distance from the base; the lowest spines are short and often nearly vertically outstanding at origin but gently bent upwards in the outer parts. Higher up the ray, the spines grow out even more obliquely from the rhachis. The longest spines are about 30 μ long and are found in the middle parts or somewhat below the middle, of the ray. The cruciate basal rays are about 55 μ long and gradually tapering to the pointed distal end. They show a few microtubercles scattered on surface.

Pinules of the oscular sieve-plate (pl. III, fig. 7) are very much taller and stronger The poplar-tree-like pinular ray is generally 450—550 μ long and 42—57 μ broad. The rhachis, 11—15 μ thick at base, is slightly thicker in the spiny parts. It terminates above with a free, narrowly conical and sharply pointed tip. The lateral spines are very strongly developed and numerous. Those situated lowest are short, conical or mammiform. The longest spines, found below the middle of the ray, are about 41 μ long. Basal rays 55—75 μ long.

The canalar pinules (pl. III, fig. 4) are distinguished by the free ray, having a sparse number of weakly developed lateral spines. They vary considerably in size. The rhachis is generally 150—230 μ long, sometimes as long as 275 μ. It is on the whole much longer than the same of dermal pinules. The lateral spines are strongest below the middle of rhachis; the uppermost ones are represented by obliquely set spinules. The basal rays are like those of dermal pinules, being nearly or quite smooth. The smaller canalar pinules pass over gradationally into those pentactine canalaria in which all the five rays are perfectly smooth and spineless. In these the free ray is either quite like the basal rays or is distinguished only by being somewhat longer than the latter (pl. III, fig. 5). — The excurrent canals show pinularly developed canalaria in moderate abundance, while in the incurrent canals these are rare, being greatly superseded in number by the simple-rayed form.

The hypodermal strands are formed, as usual, of rhabdodiactins and of the paratangential rays of orthopentactine hypodermalia. The former do not differ in any way from the choanosomal megascleric rhabdodiactins. The hypodermal pentactins have smooth, tapering rays, their paratangentials reaching 1 mm. in length and 100 μ in thickness at base. In the sieve plate beams the pentactins occur but rarely, their support being afforded principally by rhabdodiactins.

The long needles of the basal tuft may be nearly 0.5 mm. thick. Most of them show in the lower parts, for a variable extent of their length, corroded remnants or other indications of a denticulate spiral ridge or ridges. The natural inferior end of basalia was observed only in small and immature ones, taken from the columella of specimen B (pl. III, fig. 10). In these the inverted-dome-like anchor-knob may be 220 μ broad, and is furnished with 7 or 8, broad and nearly conical teeth of unequal sizes. From the anchor the shaft starts out with a thickness of 60 μ; it soon commences to exhibit rather broad spines (fig. 10, *c*) which are at first small but gradually grow in prominence superiorly. Within 3 mm. distance from the anchor the shaft acquires an unusually strongly, and at the same time a peculiarly irregular, spiny character (fig. 10 *b*). The spines here are of an elongate conical shape but of various sizes, the largest reaching a length of 70 μ or over. They are arranged close together, probably in one or more spiral series but with frequent interruptions in the continuity of these. These interruptions, coupled with the disuniformity in size of the spines, cause the irregular appearance, above referred to. A short distance further up the shaft, the spines are again very short and give rise, apparently by their lateral union, to a denticulate and interruptedly spiral-like ridge of the usual appearance. Still further above (fig. 10 *a*), where the shaft may be 130 μ thick, the denticulation of the ridge disappears altogether; and finally for some length still of the shaft, there is visible an indication of the ridge in the form of a wave-like swelling of the shaft surface.

But to return to the spiculation of the type specimen. The choanosomal supporting spicules seem to consist of rhabdodiactins only. I have not come across a single case of a

choanosomal macrohexactin. The rhabdodiactins are smooth throughout and taper gradually towards both ends. Only occasionally among the more slender diactins, there exist such as have the spicular centre marked externally by an annular tyle. In size the diactins vary from those, only about 1 mm. long and 12 μ thick to those nearly 9 mm. long and 200 μ thick in the middle and which may be called the tignule.

Together with the above there is an occasional occurrence of barbed oxydiactins or ambuncinates, 2 mm. or more in length and about 35 μ thick in the middle (pl. III, fig. 9). The spicular centre is externally marked with at least two small and oppositely standing spines, both bent in the same direction. Near the sharply pointed ends there exist a few (3 or 4 on each side) barbs that look almost like a mere serration of the edges. Small and slender ambuncinates, such as exist in abundance in *H. sieboldi*, are entirely wanting. The infrequent occurrence of the spicules in question as well as the weak development of the barbs on them may perhaps be taken for indications that the species is either on the verge of losing the ambuncinate or in an inceptional stage of acquiring it by differenciation from the ordinary rhabdodiactin of the choanosome with which it is manifestly most nearly affiliated.

There further occur in the choanosome intermedial microxyhexactins of a regular shape (pl. III, fig. 8). These are fairly common and at certain places quite numerous. The rays are slim, smooth or nearly so, and never echinated; generally straight, sometimes slightly bent but not in a hook-like manner. The dimensions vary greatly, the rays measuring 60—120 μ or more in length and not over 2 μ in basal thickness. In certain parts of the choanosome, microxyhexactins, averaging 70 μ in ray length, were found quite numerously together. Sometimes the spicules in question are pentactine, and this form seems to lead them over gradationally to the canalar pinule through the simple-rayed pentactine canalaria before mentioned. Rarely there were met with small and slim-rayed oxystauractins which are probably to be looked upon likewise as a derivate from the microxyhexactin.

Acanthophores occur in the usual way. They look very much like those of *H. sieboldi* and are mostly robust stauractins with rays, thickly tubercled in the distal half of their length and which may be 275 μ long with basal thickness of about 27 μ.

The macramphidisc is found in moderate abundance in the dermatosome as well as in the oscular sieve-plate. Their length is generally 440—500 μ. Umbel 145—175 μ across at the expanded end; its length 110—145 μ, equal to about $^1/_3$ the length of the whole spicule or somewhat shorter; bell-like in general shape, rounded at the pole, with or without a perceptible out-flaring near the expanded end. The teeth, of which there are usually 8 to each umbel, are broad (up to 24 μ) and rounded at the free end. The axial shaft may be 30 μ thick; it bears around the spicular centre a whorl of an indefinite number of tubercles. Occasionally there occur on the shaft one or more additional tubercles at a position somewhat less than halfway from the centre to either of the umbels, and in more than one instance I have seen them form there a second whorl around the shaft. — In specimen B the macramphidisc was found to be smaller, measuring 350—420 μ in length, and their umbel-teeth to be always lancet-shaped and pointed at tip; the tubercles around the spicular centre were sometimes very weakly developed or even entirely wanting.

The mesamphidisc did not come under observation in both specimens A and B.

The micramphidisc occurs in all parts of the body, but nowhere in any great abundance. Length 19—15 μ; umbel not over 5.5 μ broad, and $^1/_3$—$^1/_2$ as long as the entire length. Axial shaft slender, generally with some tubercles in its middle.

Let now be described the spiculation of specimen C, which is provisionally referred to the present species. For the sake of comparison, some facts relating to the type (specimen A) of *H. topsenti* and to *Chalaronema sibogae* are given in parenthesis.

The dermal pinule (pl. II, fig. 11) is of essentially the same appearance as that of the two specimens just described, though slightly differing in dimensions. The plumose pinular ray is 150—200 μ high and 30 μ or 35 μ broad in the broadest parts (in A 130—154 μ long and 44 μ broad; in *Ch. sibogae* 140—150 μ long and 40 μ broad). The basal rays are about 80 μ long and vertically microspiny (in A about 55 μ, in *Ch. sibogae* 53—68 μ long).

The sieve-plate pinule is, in its general appearance and dimensions, more like that of specimen A than of *Ch. sibogae*. The pinular ray is generally 440—520 μ, sometimes only 275 μ, high and up to 50 μ broad, the rhachis measuring 11—12 μ thick at base (in A 450—550 μ long and 42—57 μ broad; in *Ch. sibogae* the length up to 800 μ or more by a breadth of 65 μ). It is decidedly shorter than in *Ch. sibogae*. The basal rays are 95 μ long and 12 μ thick at base (in A 55—75 μ, in *Ch. sibogae* 75 μ long).

The canalar pinule is usually relatively small, the basal rays being 50 μ or thereabout in length, and the spineless or sparsely spiny free ray about as long or longer in varying degrees.

The supporting megascleres of the dermal layer, the sieve-plate and the choanosome are essentially the same as in specimen A or in *Ch. sibogae*. Only a great part of the diactine elements seemed to be of a somewhat coarser calibre than in either, there being found, among the filamentous ones, many that are comparatively short and thick and of a slender spindle-like shape, while others are strongly developed tignules. The tignules are either nearly straight or bent like a boomerang, and may be 8 mm. or more long by a thickness in the middle of 384 μ (in A 200 μ, in *Ch. sibogae* 100 μ thick).

Ambuncinates of less than 2 mm. length were met with in some number. The barbation was in some cases about as poorly developed as in specimen A, while in some others its condition nearly agreed with that in *Ch. sibogae*, certain of the barbs present being bent in a hook-like manner.

Strong-rayed macroxypentactins are numerously present as hypodermalia. Their paratangential rays may be 670 μ long and 60 μ thick at base. Macroxyhexactins do not occur in the choanosome.

As intermedial holactine spicules of the choanosome there is a common occurrence of regularly shaped and slim-rayed microxypentactins and microxystauractins. The latter appear to be somewhat commoner than the former. Both are of a relatively large size, measuring generally 120—232 μ, and most commonly about 160 μ, in the length of rays. The spicules in question evidently correspond to the microxyhexactin (occasionally pentactin, rarely stauractin) that we have seen in the type of *H. topsenti* (length of rays 60—120 μ, commonly only 70 μ). Here exists, it seems, the most notable difference in spiculation between the two specimens. On the other hand, the common occurrence of microstauractins brings the specimen under question into a near agreement with *Ch. sibogae*, in which the corresponding spicule is most

commonly stauractine and occasionally pentactine or hexactine with rays of not over 180 μ or 200 μ length.

The macramphidisc measures 285—430 μ, most commonly about 350 μ, in length (in A 440—500 μ; in *Ch. sibogae* 275—310 μ or 300—340 μ). The umbel is 120—150 μ broad and 100—140 μ long, the length being equal to $^1/_4$—$^1/_3$ the length of the whole spicule. In shape it is semioval and often, though not always, perceptibly out-flaring at the rim as in specimen A. It is made up of 8 lanceolate teeth with rounded or obtusely pointed free end. The axial shaft is always provided with a whorl of tubercles around the spicular centre; for the rest the surface is either quite smooth or shows a varying number of scattered tubercles. All in all, the macramphidisc exhibits no important difference as regards shape and proportion of parts from that of the types of either *H. topsenti* or *Ch. sibogae*. It occurs commonly in both the dermal layer and the oscular sieve-plate. In some parts of those regions it is very numerously present.

As regards the mesamphidisc, I was long under the impression that it is entirely wanting in the specimen, until finally I came across a single case of an amphidisc which might be called a mesamphidisc. It occurred in a preparation of the choanosomal tissue. It is of an elongate elliptical shape, 36 μ long and 16 μ broad. The umbel, made up of numerous slender teeth, is of a length between $^1/_2$ and $^1/_3$ of the length of the whole spicule. The axial shaft is rough on surface.

The micramphidisc is common, at places very numerous, in both the dermal layer and the sieve-plate. In other parts of the body it is much less common or even quite rare. In length it measures 20—13 μ. The umbel is usually $^1/_3$ the length of the whole spicule or somewhat longer; sometimes $^1/_4$ the same. The axial shaft is obsoletely rough.

Taken all in all, the fragmentary specimen in question has a spiculation, which, so far as it is represented, agrees pretty well with that of the types of both *H. topsenti* and *Ch. sibogae*, or combines the characters of both these forms. What differences there exist from either, may perhaps be regarded as not extending beyond the range of individual variation in each. In the incomplete state of the specimen it is not easy to decide which of the two Hyalonematid forms it should be ascribed to. The fact that it was obtained at a locality about the same as that whence came the type of *Ch. sibogae* (Kei Islands), but considerably distant from that of the type of *H. topsenti* (Halmaheira Sea), may be said to lend support to the assumption that it possibly represents the former genus and species.

Remarks. — Of all the known species of *Hyalonema*, the nearest ally of *H.* (*Pteronema*) *topsenti* is probably *H.* (*Pteronema*) *cebuense*, a species which was described by Higgin (1875) from a specimen obtained at Cebu, Philippine Islands. The description and figures given by him of that species, though not so complete as might be desired, go far enough to show that it closely resembles *H. topsenti* in many respects, but notably in the plumose character of the dermal pinule, which character, in combination with certain others, marks it as a member of the subgenus *Pteronema*. At the same time, the Philippine form, as against *H. topsenti*, seems to be specifically well characterized in several ways, f. i., in the ambuncinate being provided with much longer hook-like barbs; in the intermedial microhexactin being armed near the end of rays with a few but prominent hook-like spines; in the presence of moderately large oxystauractins

similarly spined at the extremity of rays; in the occurrence of small mesamphidiscs with vertical spinules on the axial shaft, etc.

From the neighbourhood of Banda Islands is known another *Pteronema* species, which was described by F. E. Schulze in the "Challenger" Report under the name of *H. globus*. This differs from *H. topsenti*, amongst some other points, in the smaller dermal pinule, the rhachis of which terminates with a conical end, and in the smaller macramphidisc with umbels distinctly truncate at the pole.

Attention has already been called to the remarkably close similarity in spiculation between *H. topsenti* and *Chalaronema sibogae*, in spite of the marked difference in the condition of their basal tuft, which difference I have regarded to be of sufficient weight to base even generic distinction on.

4. *Hyalonema* (*Coscinonema*) *kirkpatricki*, n. sp. (Plate II, figs. 12, 13. Textfig. 6).

Stat. 271. 5°46′.7 S., 134°0′ E. 1788 m. 3 specimens.

Diagnosis. — Body shaped somewhat like a sculptor's mallet but with distinct gastral depression, the surface of which is lined all over with a gastral lattice with small and closely distributed open meshes. Dermal surface showing finely and regularly rectangular-meshed hypodermal latticework. Dermal pinule with short-spiny, slender pinular ray 114—137 μ (or 120—150 μ, or 110—165 μ) long. Gastral pinule somewhat larger than, but otherwise similar to, dermal pinule. Beams of hypodermal latticework made up nearly entirely of macroxypentactine paratangentials; same of gastral lattice very largely of rhabdoxydiactins. Choanosomal megascleres predominantly rhabdoxydiactins not over 4 mm. long, amongst which occur some macroxyhexactins. Intermedial microxyhexactin numerous, with rays gently curved at end, 60—80 μ or more in axis length. Macramphidisc 300—430 μ (or 430—450 μ) long; the umbel with 8 pointed teeth, semispherical or semiovoidal, 110—143 μ (or 155—175 μ) broad and 0.20—0.25 times as long as the length of the whole spicule; the shaft thick, smooth, frequently with some tubercles around the spicular centre. Mesamphidisc numerously present, small, usually 38—27 μ (or 50—23 μ, or 55—30 μ) by 15—9 μ; the umbel longer than $^1/_3$ the whole spicular length; the axial shaft swollen in the middle and bearing vertical spinules. Micramphidisc 20—12 μ long, the axial shaft without spinules, rare.

Description. — This new species is based on three specimens (A, B, C) from Stat. 271, west of the Aru Islands. They are all incomplete, being torn off in the lower parts of body and entirely lacking the root-tuft. Moreover, they are in a partially collapsed state. Nevertheless, it can be made out that the body in the uninjured state must have been of a shape like a sculptor's mallet, though with irregularities on the lateral surface and with the upper truncate end more or less concavely sunk in, thus forming a distinct, freely open gastral depression (pl. II, figs. 12, 13). All the individuals represented by the specimens must have measured about 90 mm. in the height of body; one of them can be said to have been about as broad as high, while the two others seem to have measured somewhat less in breadth than in height. The gastral depression or cavity may have been 30—50 mm. deep in the different individuals. It cannot be told if there existed a central cone in the gastral depression. The margin of the

sponge wall is irregularly wavy and at places indented. It is thick, either rounded or slightly angularly edged, and without a cuff or a fringe of marginal needles.

The dermal surface is smooth and presents to the naked eye a remarkably finely and regularly checkered-like appearance, not unlike that of a fine linen fabric, due to the finely meshed latticework formed by intersecting transverse and longitudinal systems of thin hypodermal threads (pl. II, fig. 12). These threads scarcely ever exceed 100 μ in thickness, while the quadrate meshes bounded by them measure generally only 0.25—0.5 mm. in the length of sides. Under the hand-lens the meshes are generally seen to be filled in by the cribellate dermal membrane. At places, however, the dermal pinules occur so crowdedly together over a considerable area of the surface that this may appear uniformly finely granular, concealing to a measure the dermal membrane as well as the hypodermal lattice.

The ostia or apertures into incurrent canals, situated close under the dermal layer but scarcely discernible through it, are all small, generally measuring not more than 2 mm. in width.

The gastral cavity is lined all over its surface with a small-meshed and continuously uniform-looking sieve-like layer: the gastral layer (pl. II, fig. 13). This layer stands in close connection with the inner choanosomal surface. It is thrown into much folds in keeping with the unevenness of the latter, except over the apertures of excurrent canals. The small open meshes of the layer, which never reach quite 1 mm. in maximum width, are frequently triangular or quadrangular with rounded corners, but otherwise indefinite, in shape. The beams are thin but much stronger than those of the hypodermal lattice. They run without definiteness as to direction. Unperforate tracts do not exist; hence, the open meshes are distributed uniformly close together all over the entire extent of the gastral layer. The appearance of the layer is much like that of the same of *H.* (*Coscinonema*) *toxeres* and *H.* (*C.*) *conus* as figured by F. E. SCHULZE in the "Challenger" Report, Pls. XXIX and XXXIII, though the pore-like meshes seem to be smaller and more closely crowded than in either of these species.

Through the gastral layer are visible a number of small and mediumsized postica or apertures of excurrent canals. In the axial parts, it seems there existed especially wide subcentral canals, presumably four in number; but these are left only in traces owing to the tearing off of the parts together with the columella.

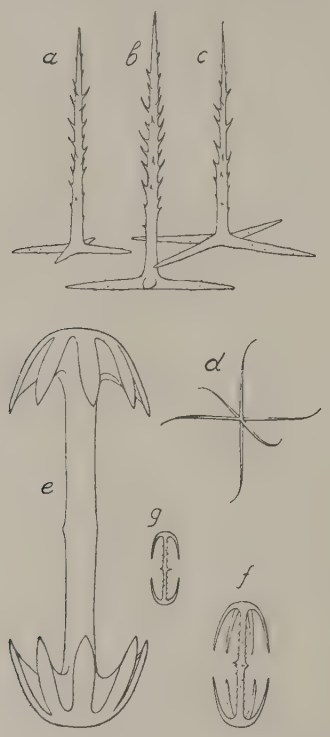
The sponge is very soft in the wet state. When dried, it is light and of a very delicate texture.

Spiculation. — The study of the spicules was done chiefly on specimen A, shown in plate II, fig. 12. The two other specimens, B (fig. 13) and C, agree very well with it in the matter of spiculation as in general macroscopic features.

The dermal spicule (textfig. 6, *a*) is small, with the distal ray generally 114—137 μ, sometimes only 95 μ, long and about 5 μ thick at base. (In B 120—150 μ, in C 110—165 μ long). The rhachis of that ray tapers gradually towards the finely pointed distal end and is furnished with spines which are neither long nor very profuse in number, so that the entire ray is barely plumose and decidedly slender. A short distance from the base the spines commence to exist at first as insignificant tubercles set at rather wide intervals. Distally on the ray they grow longer, attaining greatest development beyond the middle of its length, but soon again to become shorter and finally to disappear altogether on the freely outstanding terminal parts of

the rhachis. The greatest breadth of the ray does not exceed 15 μ, as measured transversely from tip to tip of longest opposite lateral spines. The cruciate basal rays of the spicule are about 45 μ long, tapering towards the tip and sparsely tubercled on surface.

The gastral pinule (textfig. 6, *b*) is on the whole somewhat larger and a little more numerously spiny than the dermal, but otherwise very similar in appearance. The rhachis is generally 130—150 μ (in B 120—220 μ, in C 120—175 μ) long and nearly 7 μ thick at base. The lateral spines are best developed in the middle parts of its length, where they may be 10 μ long and may give the ray a breadth of 15 μ. The basal rays are essentially similar to those of the dermal pinule.



Textfig. 6. — *Hyalonema* (*Coscinonema*) *kirkpatricki* n. sp.
a dermal pinule. *b* gastral pinule.
c canalar pinule. *d* microxyhexactin.
e macramphidisc. *f*, *g* two mesamphidiscs.
Fig. *e* × 150; all other figures × 300.

Canalar pinules (textfig. 6, *c*) were observed in moderate abundance on the wall of excurrent canals. They appear much like the dermal pinule and are of about the same size, though frequently the rays are perceptibly more slender, the basal rays longer, and the lateral spines on the free ray somewhat less numerous.

The hypodermalia are nearly exclusively smooth-rayed macroxypentactins, in which the regularly cruciate paratangentials measure generally 250—800 μ in length and 16—40 μ in basal thickness, while the unpaired proximal ray is usually somewhat longer than paratangentials of the same spicule. Usually two, sometimes three, paratangentials of different hypodermalia are combined in a strand of the latticework, the spicular centres being situated at the points of intersection of the strands. Seldom the strands are seen to be strengthened by the addition alongside of rhabdoxydiactins under 1 mm. length and 15 μ thickness in the middle and in no wise distinguishable from those of the choanosome. On the other hand, the principal megascleric elements of the gastral layer are rhabdoxydiactins, the pentactine elements occurring here only at isolated positions. The said diactins again agree completely with those of the choanosome in all respects.

The supporting spicules of the choanosome are predominantly rhabdoxydiactins, amongst which is an occasional occurrence of macroxyhexactins. The rhabdoxydiactins are mostly small, being ordinarily 1—3 mm. long and not over 20 μ thick. Occasionally they attain a thickness of 40 μ in the middle by a length of 4 mm. or under, and may then be called the tignule. All the diactins are smooth throughout their length. Certain, but not all, of the more slender diactins may show an annular swelling or some small tubercles around the spicular centre. The macroxyhexactins are either regular or have rays more or less distinctly unequal in length. They vary considerably in size, though on the whole large or moderately large. The rays, which are smooth throughout, may be 300—660 μ in length and 9—30 μ in basal thickness.

Ambuncinates do not occur in the species.

Microxyhexactins (textfig. 6, *d*) are present in great abundance in the choanosome. They

have rays which are gently bent near their distal end. This bending usually takes place in opposite directions at the two ends of each axis. The spicules are small, measuring 60—80 μ, sometimes as much as 118 μ, in axis length (in B and C generally 57—95 μ). The rays are only about 2 μ thick at base. They appear nearly smooth under a low power of the microscope, but are in reality rough, owing to the presence of some minute conical tubercles on the surface. The same microxyhexactin occurs also in the gastral layer though in sparse distribution.

In specimen A, a small portion of the basal pad was found preserved, so that the acanthophore could be examined. The acanthophores are mostly stauractins, and sometimes tauactins or pentactins, with rays up to 250 μ long and 20 μ thick and, as usual, studded with conical tubercles in the distal parts. The spicules seemed to show no special features of systematic importance. — I have no observation on the basalia since these were left in none of the specimens on hand.

The macramphidisc (textfig. 6, *e*) is present in moderate abundance in the periphery of the choanosome, and sparsely in both dermal and gastral layers. It is mostly 300—400 μ long, unusually small ones reaching down to 275 μ long (in B and C commonly 430—450 μ long). The umbel, composed of 8 moderately broad and sharply pointed teeth, is usually semispherical, otherwise semiovoidal; 110—143 μ (in B and C 155—175 μ) broad and 0.20—0.25 times as long as the entire spicular length. The axial shaft is strong, being 23—30 μ thick. It is either smooth all over or shows around the middle an indefinite number of low and rather indistinct tubercles in a whorl.

The mesamphidisc (textfig. 6, *f*, *g*) is met with commonly in the choanosome as well as in the gastral layer, occurring together with the microxyhexactin but most numerously in the wall of the larger excurrent canals. It is of an elongate ovoid shape, the length ranging usually 27—38 μ by a breadth of 9—15 μ; sometimes it reaches a size of 50 μ by 19 μ, and very rarely of 65 μ by 27 μ. The deeply bell-shaped umbel is generally about as long as it is broad at the rim, the length being always longer than $^1/_3$ the length of the whole spicule. In the larger ones of the spicule each umbel consists of 8, but in the smaller ones of 10—12 teeth, which are always slender and sharply pointed at end. The axial shaft is rather slender but slightly swollen in the middle, and is armed with numerous slender and vertically standing spinules, of which those on the central swelling are the longest and strongest.

The micramphidisc, 20—12 μ long and 8—5 μ broad, is exceedingly rare. The axial shaft may show the central swelling, but is devoid of the spinules which are present in the mesamphidisc. The micramphidisc probably passes over gradationally into the mesamphidisc.

Remarks. — *Hyalonema* (*Coscinonema*) *kirkpatricki* seems to be a species well characterized by a combination of following characters: the presence of a gastral depression lined with a densely small-meshed gastral sieve-layer; the fine linen-fabric-like appearance of the dermal surface; the relatively small pinules, both dermal and gastral, with short-spiny, barely or scarcely plumose free ray; the small microxyhexactin with curved and nearly smooth rays; the large macramphidisc with semispherical or semiovoid umbels and with axial shaft not tubercled, except in the middle; the small mesamphidisc with the axial shaft showing numerous vertical spinules.

Most of the species I have associated with *H. kirkpatricki* under the subgenus *Coscinonema*

(p. 50) are very similarly structured and spiculed, and are no doubt closely related forms, amongst which it is no easy matter to pick up this or that as being especially nearly allied to a particular one of the group. Nevertheless, as possibly the nearest ally of the present species may be pointed out *H.* (*Coscinonema*) *conus* F. E. Sch. known from the south of Australia. Another *Hyalonema* form, showing nearly an equally far-going agreement in organization with the present species, is *H. poculum* F. E. Sch. from off the coast of Chili, but this is provisionally referred to the subgenus *Prionema* in following of v. LENDENFELD's (1915, p. 151) suggestion. The fact may be taken for an indication that the two subgenera, *Coscinonema* and *Prionema*, are without any natural demarkation between them. Finally, *H.* (*Coscinonema*) *lamella* F. E. Sch. of the Indian Ocean may be mentioned as being of a spiculation closely similar to that of *H.* (*C.*) *kirkpatricki*, though the two species seem to differ widely in external macroscopic characters of body.

5. *Hyalonema* (*Cyliconema*) *apertum maehrentali* F. E. Schulze. (Pl. II, fig. 15. Pl. IV, figs. 1—8. Textfig. 7—15).

H. maehrenthali F. E. Schulze, 1895, Ind. Hex., I, p. 41.
H. affine reticulatum F. E. Schulze, 1899, Sitz. Ber. Ges. naturf. Fr., Berlin, p. 127. — 1902, Ind. Triax., p. 29.
H. apertum F. E. Schulze, 1904, Vald. Rep. Hex., p. 91.

Stat. 52. 9° 3′.4 S., 119° 56′.7 E. 959 m. 1 specimen.
Stat. 137. 0° 23′.8 N., 127° 29′.0 E. 472 m. 1 specimen.
Stat. 145. 0° 54′.0 S., 128° 39′.9 E. 827 m. 1 specimen.
Stat. 161. 1° 10′.5 S., 130° 9′.0 E. 798 m. 1 specimen.
Stat. 173. 3° 27′.0 S., 131° 0′.5 E. 567 m. 1 specimen.
Stat. 208. 5° 39′.0 S., 122° 12′.0 E. 1886 m. 2 specimens.
Stat. 251. 5° 28′.4 S., 132° 0′.2 E. 204 m. 1 specimen.
Stat. 254. 5° 40′.0 S., 132° 26′.0 E. 310 m. 1 specimen.
Stat. 314. 7° 36′.0 S., 117° 30′.8 E. 694 m. 1 specimen.
Stat. 316. 7° 19′.4 S., 116° 49′.5 E. 538 m. 1 specimen.

There are in the "Siboga" collection eleven *Hyalonema* specimens obtained at ten different stations, which may be identified with *H. maehrenthali* F. E. Sch., 1895, though not altogether without a thought of misgiving in most of the cases. That species was later given up by the describer (1899 *b*, 1902, 1904), who relegated it to the synonymy of *H. apertum* F. E. Sch. It is now revived but with a subspecific status given it under the species just mentioned. As a result of my studies on the "Siboga" material, it has turned out that *H. apertum maehrenthali*, as the form in question should be called in my opinion, apparently represents a form widely distributed in the East Indian Seas and fairly well distinguishable from, though in some cases found in transitory character, to the typical form of *H. apertum*. Besides *H. maehrenthali*, many other congeners of *H. apertum*, which now stand as distinct species [1]), I am greatly inclined to take also under that species as subspecies or varieties; but the taking of a decisive step on the matter may well be deferred until more progress in our knowledge shall have been achieved.

1) As, f. i. *H. molle*, *H. pirum*, *H. tulipa*, *H. nicobaricum*, *H. somalicum*, and perhaps some more of the subgenus *Cyliconema*.

Diagnosis. — *Hyalonema apertum* F. E. Sch., in the broad sense of its consisting of the two subspecies, *H. apertum apertum* and *H. apertum maehrenthali*, may be briefly described and its variability indicated as follows. *Hyalonema* (*Cyliconema*) with body cup-like or funnel-like, or top-like when the gastral cavity is everted, as it frequently is. Without oscular sieve-plate or gastral covering layer. Columella more or less projecting above as central gastral cone. Widest excurrent (subcentral) canals usually 4 in number. Hypodermal threads forming network with meshes from regularly quadrate to irregular in shape. Dermal and gastral pinules of very variable length, short-spiny, slender, with rhachis tapering from base to finely pointed tip. Hypodermal megascleres partly oxypentactins, partly rhabdodiactins. Choanosomal megascleres chiefly rhabdodiactins, with a varying number of macrohexactins in addition. Diactine tignules present or not present. Without ambuncinate. Intermedial microxyhexactins small, with rays either straight or curved to a variable degree and roughened by microtubercles or bearing spinules which may be vertical, retrovert or otherwise. Macramphidiscs variable in dimensions and in number of occurrence; the umbel from semispherical to bell-like in shape, generally 0.20—0.25 times as long as the whole spicule or somewhat longer, with 6—8 teeth, rounded or obtusely pointed at end; the axial shaft tuberculated, a number of the tubercles forming a whorl around the middle of shaft. Mesamphidisc inconstant in occurrence; when present, variable in dimensions and number, with deep bell-like umbel, about $^1/_3$ as long as the whole, spicule or longer; grading over into micramphidiscs which always occur in abundance.

Now, *H. apertum apertum* specially may be characterized as follows:

Dermal pinules 100—200 μ long, rarely reaching up to 250 μ; their average length in different individuals ranging from 120 μ to 170 μ, seldom nearly 200 μ (representative cases of the range of individual variation in the length of dermal pinules: 100—200 μ, 120—150 μ, 120—200 μ, 140—190 μ. 145—250 μ). Gastral pinules in average shorter than dermal pinules of the same sponge, sometimes only half as long as the latter. Tignule present, sometimes absent. Macramphidiscs as short as 130—185 μ, others in the same sponge longer, reaching up to 200—350 μ length. Mesamphidiscs none, or present in variable number. — Known from eastern coast of Japan, Andaman Islands (F. E. Sch., 1895, p. 39; 1902, pp. 27—29), Nicobar Islands (F. E. Sch., 1904, p. 93), southwestern coast of Sumatra (F. E. Sch., 1904, pp. 92, 93).

In contrast to the above, *H. apertum maehrenthali* may be differentially diagnosed as follows:

Dermal pinules longer (absolutely, or at any rate in average length) than in *H. apertum apertum*, varying in their average length from about 200 μ to 350 μ or more (representative individual cases of the range of variation: 175—230 μ, 220—350 μ, 250—350 μ, 320—365 μ, 320—400 μ, 330—440 μ). Gastral pinules, when fully developed, all or in part much longer than longest dermal pinules of the same sponge, up to 380 μ or even 500 μ long. Tignules present. Macramphidisc usually over 250 μ in minimum length and up to maximum length of 300—460 μ. Mesamphidisc numerous in canalar wall. — Known from Andaman Islands, Java Sea, Kei Islands, Halmaheira Sea, Molucco Passage.

Description. — The specimens of *H. apertum maehrenthali* obtained by the "Siboga" at ten different stations, will be referred to as specimens A—J. I deem it worth while to describe each of them separately in order to given an idea of the range of variation of the subspecies.

Specimen A. (Pl. IV, figs. 1, 2; textfig. 7). From Stat. 316, a spot to the northwest

of Kangeang Island in Java Sea. This is a goodly sized sponge body of a thick-walled, calyx-like and cylindrico-subconical shape, with the narrowed lower parts broadly rounded at the basal end (Pl. IV, figs. 1, 2). Length 100 mm.; breadth across the truncate upper end 50—55 mm. The funnel-like gastral depression, about 44 mm. deep in the central parts, leads below into two wide subcentral canals, situated close together and running deep into the body. A gastral cone probably existed but was torn off and lost, together with the columella and the root-tuft. The thick marginal wall is rounded at the rim, along which, on the outside, runs the dermatogastral boundary line, well defined at least in some parts of it, by the surface being obtusely angulated or by the presence of an inconspicuous and discontinuous fringe of marginal spicules. Thus, the general habitus of the sponge is very much like that of certain individuals of *H. apertum apertum* and in no less degree, of *H. molle*, *H. nicobaricum*, *H. somalicum* and *H. valdiviae*, figured by F. E. SCHULZE in the "Valdivia" Report. The sponge is of a rather firm consistency.

The dermal surface shows a delicate but distinct hypodermal network, composed of thin (at most 150 μ thick) transverse and longitudinal threads, which, by intersecting, form moderately regular, quadrate meshes, generally 1—1.5 mm. times in the length of sides. The meshes, where these were not subjected to disturbing influences, are filled in by an extremely delicate, gauze-like dermal membrane. The canalar apertures, visible through, and situated close under, the dermal layer, are as a rule less than 2 mm. in diametre. On the dermal surface there exist some sharp-edged, moderately large apertures freely opening to the exterior. These are either openings which were produced by commensal Anthozoans or those for the outflow of water which were formed by the adventitious breaking through of the excurrent canal system.

The depressed gastral surface is perforated at rather wide intervals by a number of excurrent canalar apertures, varying in size from less than 1 mm. width to that of the largest subcentral canal of an oblong shape, fully 7 mm. long. Between the apertures the surface is of a close-grained or velvety appearance, due to the closely crowded presence of gastral pinules which completely conceal all hypogastral strands.

Dermal pinules (textfig. 7, *a*) with free ray slender, whip-like, generally 320—365 μ long, about 5 or 6 μ thick at base; lateral spines not longer than 4 or 5 μ as measured on the side, facing the rhachis. Basal rays sparsely and obsoletely microtubercled, conically pointed at end, 26—38 μ long as measured from the spicular centre. The pinules stand in a row or rows on hypodermal strands, and in a scattered distribution on the gauze-like dermal membrane. — Diactine pinules occur isolatedly along the marginal edge-line, without forming a continuous row of any conspicuousness.

Gastral pinules (textfig. 7, *b*) similar to dermal, but with distinctly longer and more strongly developed free ray which is generally 440—500 μ long and 7.5—9 μ thick at base. Longest spines on it reach a length of about 10 μ. Basal rays 30—38 μ long. The great length of the gastralia and their thickly crowded presence form a striking feature of the specimen. Quite a short distance within the apertures of both subcentral and peripheral excurrent canals, the pinules cease to exist altogether. In fact, no canalar pinules have been discovered.

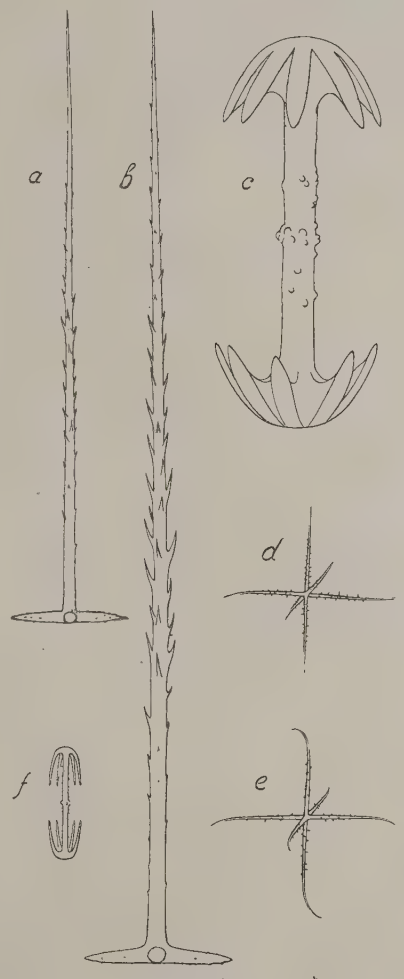
Hypodermal megascleres consisting of variously sized, smooth oxypentactins and rhabdoxy-diactins, both numerously present. The former with paratangential rays up to 1.9 mm. long and 130 μ thick at base, and with proximal ray about as long as or somewhat shorter than

paratangentials of the same spicule. Probably on account of this comparative shortness of the proximal ray, the pentactins readily detach themselves from the sponge and are apt to stick in number to the finger while handling it. The rhabdodiactins combine to form hypodermal threads of varying strength, at places by themselves alone, and at other places in company with paratangentials of the pentactins. The diactins do not exceed 1.5 mm. in length, are 6—35 μ thick in the middle, and generally show a central annular swelling.

Oxypentactins, like those of the hypodermal network but somewhat smaller, occur occasionally as hypogastralia. — In the canalar wall pentactins seemed not to occur.

Choanosomal megascleres are chiefly rhabdoxydiactins, amongst which bow-like or nearly straight tignules, up to 8 mm. by 160 μ, are not uncommon. For the rest, the diactins are mostly under 2 mm. by 20 μ. They are smooth all over or subterminally faintly rough, generally without, but occasionally with a central annular swelling or tubercles. Choanosomal macroxyhexactins occur but rarely. In one case measured, the rays were about 1 mm. long and 75 μ thick at base.

Microxyhexactins (textfig. 7, *d*, *e*) were met with in the dermatosome only, rather sparsely on the whole but fairly numerously together at certain places, as f. i. in the pillars traversing the subdermal space. Axial length generally 75—90 μ, with rays 2 μ thick at base or thinner, spinulated, either straight or bent in the distal non-spinulated parts. The variation in the last mentioned respect occurs in different spicules as well as among the six rays of one and the same spicule. The bending of the rays is sometimes only weakly indicated, at other times more or less distinctly pronounced but not quite to a hook-like degree. The spinulation is brought about by short and fine spinules which ordinarily are not very numerous and which generally stand out erect but may sometimes be either retroverted or outwardly inclined. Very rarely the microhexactin is so small as to measure only 42 μ in axial length, in which case the rays are always straight and bear vertical spinules more profusely than usual.



Textfig. 7. — *Hyalonema* (*Cyliconema*) *apertum maehrenthali* F. E. Sch.
Specimen A, from Stat. 316.
a dermal pinule. *b* gastral pinule.
c Macramphidisc from dermal layer.
d, *e* microxyhexactins.
f mesamphidisc from canalar wall.
Fig. *c* × 150; all other figures × 300.

Instances of the spicule showing all the spinules uniformly retroverted like so many barbs on all the six rays, such as were figured by F. E. Schulze (1895, pl. VIII; 1902, pl. VII, figs. 8 *a*, 11 *b*), I have not met with in the present specimen. Seldom the spicule was seen in the form of a straight-rayed pentactin, in which the unpaired ray was somewhat more prolonged than any of the others.

Acanthophores are mostly diactine, less frequently stauractine or of any other form with

more than two rays. The rays are studded all over with conical tubercles, seldom leaving the proximal parts smooth.

Macramphidisc (textfig. 7, *c*) common in the dermal layer, but rare in the gastral. It was found in no other parts of the sponge. It usually lies with the axial shaft vertical to the sponge surface and placed crosswise against a hypodermal or a hypogastral strand. Length 270—385 μ, most usually considerably over 300 μ. Umbel semiovoid or nearly semi-spherical, 60—80 μ long, 110—154 μ broad; with 8, sometimes 7 or 6, lanceolate but roundly ending teeth. Axial shaft 20—23 μ thick, with rounded tubercles irregularly distributed on surface, besides forming a more or less distinct central whorl. Four macramphidiscs of representative dimensions measured as follows:

Entire length	Umbel length	Umbel breadth	Shaft thickness
270 μ	60 μ	110 μ	20 μ
350 μ	70 μ	144 μ	23 μ
374 μ	77 μ	154 μ	—
385 μ	80 μ	140 μ	23 μ

Mesamphidiscs (textfig. 7, *f*) extremely numerous in the wall of certain excurrent canals, a fact shared alike by *H. molle* but probably rarely, if at all, by *H. apertum apertum* in which they may be even totally absent or nearly so. In the dermatosome they are sparse, while in the gastrosome they are quite rare. Length generally 42—65 μ; breadth 11.5—16 μ. Umbel elongate-semiovoid, 15—26 μ long, generally somewhat longer than $^1/_3$ the entire spicular length, with 11 or 12 slender teeth. Axial shaft slender, the surface rough on account of obsolete conical microtubercles, swollen or tubercled in the middle. Measurements of representative mesamphidiscs:

Entire length	Umbel length	Umbel breadth
42 μ	15 μ	11.5 μ
50 μ	19 μ	11.5 μ
60 μ	23 μ	15 μ
65 μ	26 μ	16 μ

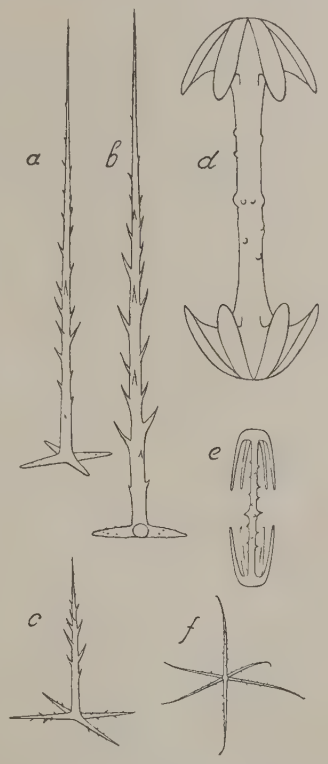
Micramphidiscs 15 μ × 6 μ—23 μ × 9.5 μ or larger in size, grading over into the mesamphidiscs. They are of the usual appearance and occur in abundance in the close proximity of the hypodermal latticework but rather rarely in all other parts of the sponge.

The above described specimen is the largest of all, referable to *H. apertum maehrenthali* in the "Siboga" collection. It is to be taken for a fullgrown individual in which the characteristic points of the subspecies should be fully developed. Especially the long and strongly developed dermal and gastral pinules give it a high degree of characterization, from which probably no systematist would hesitate to regard it as belonging to a species distinct from *H. apertum*, were it not for the intermediate characters of some of the specimens to be hereafter described.

Specimen B. — (Pl. IV, figs. 3, 4). From Stat. 314, which lies in the Java Sea to the north of Sumbawa and not very far distant from the station whence the last described specimen came from. A well preserved specimen (Pl. IV, figs. 3, 4), somewhat larger than a walnut and much smaller than A, but probably already in a stage of growth, in which the body shape as well as the spiculation have quite or nearly reached definitive development. The body is caliculate, 40 mm. high and 30 mm. across the truncate upper end. The thick marginal zone somewhat expands outwards at the rim, along which runs the sharp-edged dermatogastral boundary line.

The gastral depression, not deeper than about 10 mm., shows in the centre a thick and bluntly ending gastral cone, which is not higher than the level of the oscular margin. Around the cone open the wide subcentral canals to a number of four or five, separated by septum-like partitions. Other, much smaller excurrent canals open with variously sized apertures on the gastral surface, which, in the interspace between them, presents under the lens a granular-like appearance somewhat as in A, due to the crowded presence of gastral pinules.

Here again the dermal surface shows a number of relatively large, roundish and sharp-edged openings which internally communicate with the excurrent canalsystem. For the rest, the dermal surface distinctly presents to view a moderately regular, checker-like hypodermal latticework, in which the rectangular meshes measure 0.5—0.75 mm. in the length of sides. The entire sponge is of a firm consistence. Basal tuft preserved in the proximal *Palythoa*-covered parts only, which are only about 3 mm. thick.



Textfig. 8. — *Hyalonema* (*Cyliconema*) *apertum maehrenthali* F. E. Sch. Specimen B, from Stat. 314.
a dermal pinule. *b*. gastral pinule. *c* canalar pinule from subcentral canal. *d* macramphidisc. *e* microxyhexactin. *f* largest mesamphidisc observed. Fig. *d* × 150; all other figures × 300.

Whatever difference there exists in external appearance between specimens A and B, it certainly does not transgress the range of that observable between certain individuals of *H. apertum apertum*. The spiculation is essentially the same in the two specimens, except in the length of dermal and gastral pinules.

The dermal pinules in B (textfig. 8, *a*) are notably shorter, being generally 200—250 μ (instead of 320—350 μ) long. A few measured were only about 190 μ long. The pinules are mostly found broken off at the free end of rhachis, so that I have had to be careful to select intact ones for the measurement. In the matter of the length of the dermalia, the specimen under consideration may be said to stand nearly in agreement with certain individuals of *H. apertum apertum* with unusually prolonged dermalia (up to 250 μ long), though still keeping up a somewhat greater average length. Thickness of rhachis at base about 5 μ; longest lateral spines on it 7 μ or less long on the inner side. Basal rays 26—30 μ long, nearly gradually tapering to the distal end; microtubercles on them obsolete.

The gastral pinule (textfig. 8, *b*) generally 200—330 μ long, sometimes reaching up to 380 μ. In a general way it shows its parts perceptibly more strongly developed than in the dermal pinule. It is on the whole again considerably shorter than in A (440—500 μ), though decidedly longer than in *H. apertum apertum* (not over 200 μ).

In the wide subcentral canals, and probably also in certain other canals, there is a sparse occurrence, at wide intervals, of small canalar pinules in which the free ray measures only about 100 μ or much less in length and is poor in the number of lateral spines it bears (textfig. 8, *c*).

Hypodermal megascleres are chiefly oxypentactins, supplemented by some rhabdoxydiactins of a variable length. The former have paratangential rays which may run up to 800 μ length and 50 μ basal thickness. — As usual the choanosomal megascleres are in the main rhabdoxydiactins, of which some are developed into tignules of 6 mm. or more length and 180 μ thickness in

the middle. Associated with these diactins there exist macroxyhexactins in some number. A strong macroxyhexactin observed had rays about 0.5 mm. long and 40 μ thick at base. — Microxyhexactins (textfig. 8, *f*) are common in the dermatosome, very numerous in the columellar parts, and sparse in the choanosome and the gastrosome. They are quite like those of specimen A. Axial length 46—100 μ. The rays are sometimes straight, more generally more or less bent near their end and that occasionally to such a degree as to appear hook-like. It may happen that both straight and bent rays occur in one and the same spicule. The rays are in all cases minutely and rather sparsely spinulated, the spinules being generally erect and occasionally distally inclined.

Macramphidisc (textfig. 8, *d*) common in the dermal layer. Length 240—304 μ. Umbel semiovoidal, about 0.25 times the entire spicular length or slightly longer than that; its breadth about $^1/_3$ the same or somewhat broader; with 8 teeth which are either rounded at end or of a lanceolate shape; axial shaft 15—23 μ thick, tuberculated in the usual way. It is to be noted that the smallest amphidisc found in the specimen is much larger than the same in *H. apertum apertum*, while the maximum size in both may be said to be approximately equal, a fact which holds good in relation to specimen A also. Dimensions of some representative macramphidiscs:

Entire length	Umbel length	Umbel breadth	Shaft thickness
240 μ	65 μ	76 μ	15 μ
260 μ	72 μ	84 μ	15 μ
277 μ	76 μ	118 μ	19 μ
304 μ	76 μ	125 μ	19 μ

Mesamphidiscs (textfig. 8, *e*) very numerous in the wall of subcentral and other large canals; in this respect, as also in their shape and size, quite similar to specimen A. Usually 53 μ × 15 μ — 42 μ × 12 μ in dimensions.

Micramphidiscs of 12 μ and upwards in length and of the usual appearance are fairly numerous in the dermatosome.

Specimen C. — (Pl. IV, fig. 5, textfig. 9). From Stat. 52, between the islands of Flores and Sumba. An ovoid specimen about the size of a walnut, with partially preserved root-tuft 2.5 mm. thick at the *Palythoa*-covered origin (Pl. IV, figs. 5). Body 31 mm. long, 19 mm. broad in the middle; osculum at the upper end 8—10 mm. wide; gastral cavity shallow, with a small rounded gastral cone not higher than the level of the sharp, superiorly directed oscular margin. Dermal surface showing regularly quadrate-meshed hypodermal lattice with meshes approximately 0.5 mm. wide; with some relatively large apertures, from one of which an annelid is protruding. The specimen is apparently an immature one, younger than specimen B.

Dermal pinules (textfig. 9, *a*) 175—230 μ long, the rhachis about 5.5 μ thick at base, longest lateral spines not over 7 μ long on the inner side; basal rays 32—38 μ long, gradually attenuating, obsoletely microtubercled.

Gastral pinules (*b*) giving a hairy appearance to the surface, generally about as long as the dermal but slightly more strongly developed in their parts, up to 240 μ long. The smaller gastralia lead over to canalaria (*e*), found isolatedly on the wall of subcentral canals and in which the free, sparsely spined ray is only 100 μ long or much shorter.

Hypodermalia large oxypentactins, supplemented by occasional rhabdoxydiactins. The former may have paratangentials as long as 600 μ and about 50 μ thick at base.

Choanosomal megascleres rhabdoxydiactins and macroxyhexactins. The latter are common, reaching up to 3 mm. in axial length. Tignules present, up to 500 μ long and 90 μ thick in the middle.

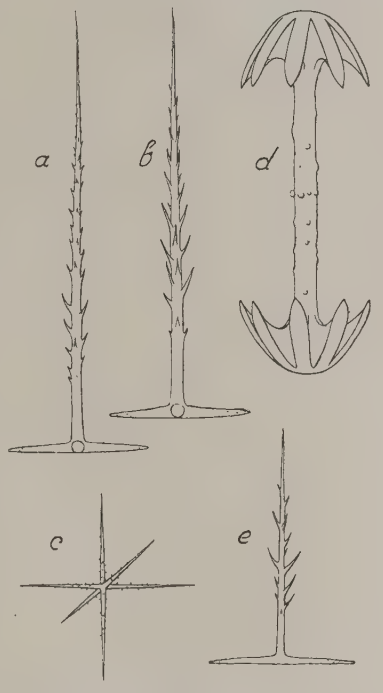
Intermedial microxyhexactins (*c*) fairly common in septa; 60—100 μ in axial length; with rays always straight and beset with minute spinules which are either erect or obliquely distally directed. The spicule in question is occasionally pentactine and seems to intergrade with canalaria.

Macramphidisc (*d*) common in dermatosome, 270—400 μ long; umbel with 6—8, lanceolate teeth. Measurements of representative macramphidiscs:

Entire length	Umbel length	Umbel breadth	Shaft thickness
400 μ	80 μ	145 μ	21 μ
352 μ	77 μ	132 μ	22 μ
330 μ	70 μ	110 μ	19 μ
270 μ	75 μ	120 μ	19 μ

Mesamphidisc fairly numerous subgastrally, sparse or absent in canalar wall; shaped exactly as in specimen B, up to 70 μ × 19 μ in size; gradually leading over to micramphidiscs of 15 μ length. These are commonly, but not very numerously, found in dermatosome as well as in gastrosome.

It may be said that the spiculation is essentially identical with that of B, except perhaps in the fact that the microxyhexactins are constantly straight-rayed.



Text-fig. 9. — *Hyalonema* (*Cyliconema*) *apertum maehrenthali* F. E. Sch.
Specimen C, from Stat. 52.
a dermal pinule.
b one of the better developed gastral pinules.
c canalar pinule from subcentral canal (this figure may also pass for a small gastral pinule).
d macramphidisc. *e* microxyhexactin.
Fig. *d* × 150; all other figures × 300.

Specimen D. — (Pl. IV, fig. 6. Textfig. 10). From Stat. 254, in the neighbourhood of Kei Islands. Another immature specimen of an elongate ovoid shape and with a stump of broken off root-tuft, surrounded by a small colony of *Palythoa* (Pl. IV, fig. 6). Body 35 mm. long, 17 mm. broad in the middle. Dermal surface smooth, perforated by a number of relatively large holes; covered with distinct, delicate-looking and regularly constructed hypodermal lattice, the rectangular meshes of which measure about 0.5 mm. or less in length of sides. Osculum at the upper end 9 mm. in greatest width, surrounded by thin-edged margin. The upper end of columella, the future gastral cone, is not yet central in position, but is in fusion with the oscular margin at one point. This indicates the backward state of development of the osculum and the gastral depression. On further development the gastral cone should separate from the margin, finally to stand isolated at the centre of the enlarged gastral area.

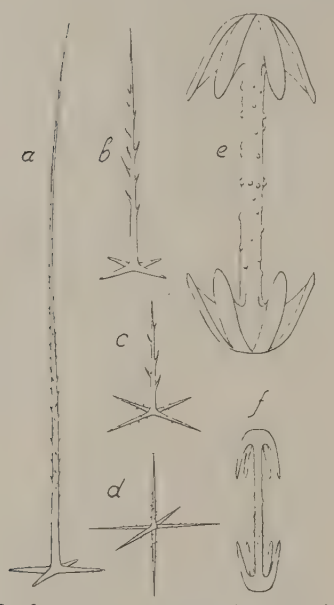
Dermal pinules (textfig. 10, *a*) 220—350 μ long; rhachis unusually slender, not more than 5 μ thick at base, distally finely drawn out; lateral spines small and inconspicuous; basal rays under 30 μ length.

Gastral pinules (*b*) not yet markedly differentiated from canalaria. — Canalaria (*c*) found

in scattered distribution, with rhachis ranging in length from 130 μ downward to 60 μ or less; spines on it sparse but better developed than in dermalia.

Hypodermalia almost entirely oxypentactins with paratangentials up to 550 μ long and 40 μ thick at base.

Choanosomal megascleres chiefly rhabdoxydiactins together with occasional macroxyhexactins. Some of the former are nearly 5 mm. long and 75 μ thick in the middle, and may be regarded as tignules in an early stage of development.



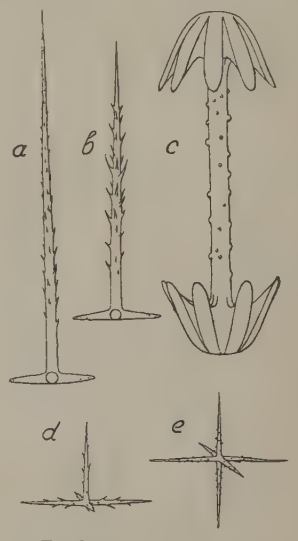
Textfig. 10. — *Hyalonema* (*Cyliconema*) *apertum maehrenthali* F. E. Sch.
Specimen D, from Stat. 254.
a dermal pinule. *b* gastral pinule
c canalar pinule. *d* microxyhexactin.
e macramphidisc. *f* an unusually large mesamphidisc.
Figs. *e* and *f* × 150; all other figures × 300.

Intermedial microxyhexactins (*d*) fairly common, usually 40—55 μ in axial length, rarely 87 μ; rays straight, roughened by conical microtubercles, which are frequently lengthened into erect or distinctly retroverted spinules. Microxyhexactins with bent rays were not observed.

Macramphidisc (*e*) numerous in dermatosome, usually 300—350 μ long; with umbel about 0.25 times as long as the entire spicule, 120—140 μ broad, with 7 (sometimes 8) teeth rounded or obtusely pointed at end. An exceptionally small macramphidisc measured 240 μ × 90 μ.

Mesamphidisc common in dermatosome and gastrosome; generally smaller than 60 μ × 15 μ, the deeply bell-like umbel being about $^1/_3$ the lenght of the whole spicule or somewhat longer. Similarly shaped, but unusually large mesamphidiscs (*f*), up to 150 μ × 43 μ, occur rarely in the dermal layer.

Micramphidisc 12 μ long or longer, common in dermal membrane but rare in other parts, grading over into the smaller mesamphidisc.

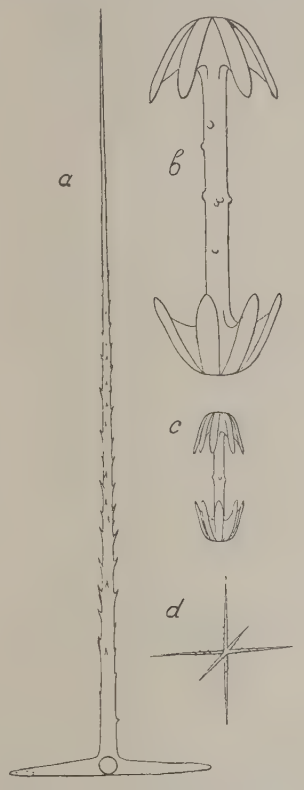


Textfig. 11. — *Hyalonema* (*Cyliconema*) *apertum maehrenthali* F. E. Sch.
Specimen E, from Stat. 251.
a dermal pinule. *b* gastral pinule.
c macramphidisc.
d microxypentactin.
e microxyhexactin.
Fig. *c* × 150; all other figures × 300.

Specimen E. — (Textfig. 11). From Stat. 251, near Kei Islands. Still another young specimen of an elongate ovoid shape, 36 mm. long and 15 mm. broad, with non-twisted root-tuft, 100 mm. long and 3 mm. thick at origin, which is surrounded by *Palythoa* polypes in a single whorl. Above, a projecting gastral cone confluent with the thin oscular margin at one point; osculum 6—9 mm. across. Dermal surface much lacerated.

Dermal pinules (textfig. 11, *a*) 190—220 μ or somewhat longer; rhachis less finely drawn out at outer end than in D; lateral spines small; basal rays 30 μ long. — Gastral pinules (*b*) scantily found, similar to, but smaller than, dermalia; not longer than 130 μ and of all size, leading down to canalaria, in which the free ray may be as short as 50 μ. Probably the gastralia have not yet attained full development. — Hypodermal megascleres chiefly oxypentactins, of which a large one may have paratangentials

600 μ long and 40 μ thick at base. — Choanosomal megascleres comprising some medium-sized macroxyhexactins among the usual rhabdoxydiactins. Some of the latter are tignules 5 mm. long and 120 μ thick in the middle. — Intermedial microxyhexactins (*e*) common, generally 60—85 μ in axial length, with straight spinulated rays, about 4 μ or less thick at base. In rare, exceptional cases, one or more rays in a spicule were found to be slightly bent near their free end. Not infrequently the same spicule is in the pentactine form (*d'*), which bridges the microxyhexactin over to the smaller canalaria with the free ray scarcely or but little differentiated from the basal rays. — Macramphidisc (*c*) numerous in the dermal layer, 300—385 μ (rarely 415 μ) long; umbel 0.20—0.25 as long as the entire spicule, 110—130 μ broad, with 8 (rarely 7) teeth rounded at end. — Mesamphidisc rather sparsely found in dermatosome and gastrosome; variously sized, rarely as large as 130 $\mu \times 44$ μ, mostly much smaller and gradually leading over to micramphidiscs of 20—15 μ length.



Textfig. 12. — *Hyalonema* (*Cyliconema*) *apertum maehrenthali* F. E. Sch. Specimen F, from Stat. 173. *a* dermal pinule. *b* macramphidisc. *c* Large mesamphidisc resembling macramphidisc in general appearance. *d* microxyhexactin. Figs. *b* and *c* × 150; other figures × 300.

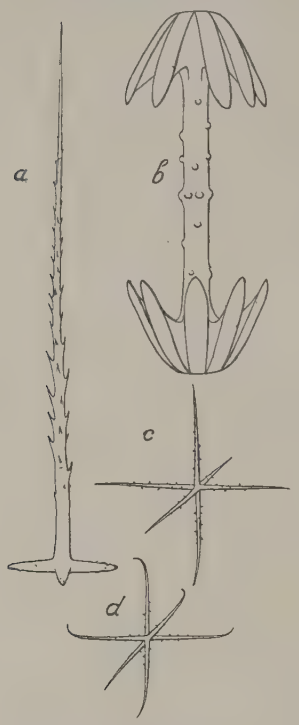
Specimen F. — (Pl. IV, fig. 7. Textfig. 12). From Stat. 173, off eastern end of Ceram. A very small pear-shaped specimen, 12 mm. high and 5—9 mm. broad; with a short remnant of basal tuft, only $^3/_4$ mm. thick, not twisted and without *Palythoa* (Pl. IV, fig. 7). At the upper end an oblong osculum of 3.5 mm. × 1 mm. External surface distinctly showing delicate hypodermal lattice with small and moderately regularly rectangular meshes.

Dermal pinules (textfig. 12, *a*) 323—400 μ long in spite of the smallness of the sponge; rhachis about 7 μ thick at base, distally finely drawn out nearly as in D; spines small and inconspicuous; basal rays about 50 μ long. — Gastral and canalar pinules not observed with certainty. — Hypodermalia as in D; the oxypentactins with paratangentials up to 500 μ length and 33 μ thickness at base. — Choanosomal megascleres rhabdoxydiactins and macroxyhexactins as usual; no tignule among the former; the latter numerous, reaching nearly 1 mm. in axial length and 35 μ in basal thickness of rays. — Microxyhexactins (*d*) common, 53—80 μ in axial length, with rough or spinulated rays which are usually quite straight but may occasionally be gently bent at the end; spinules in some cases retroverted. — Macramphidisc (*b*) fairly numerous in dermatosome, variously sized, reaching 380 $\mu \times 150$ μ, more usually about 340 $\mu \times 140$ μ, occasionally 220 $\mu \times 80$ μ or even smaller. The 8-toothed umbel approximately 0.25 as long as the entire spicule. — Mesamphidiscs not numerous; small ones 45 $\mu \times 6$ μ, with umbel of $^1/_3$ the length; others larger, up to such as are 120 μ long and greatly resemble the macramphidisc in shape and proportions of parts (*c*). — Micramphidiscs down to 13 μ length.

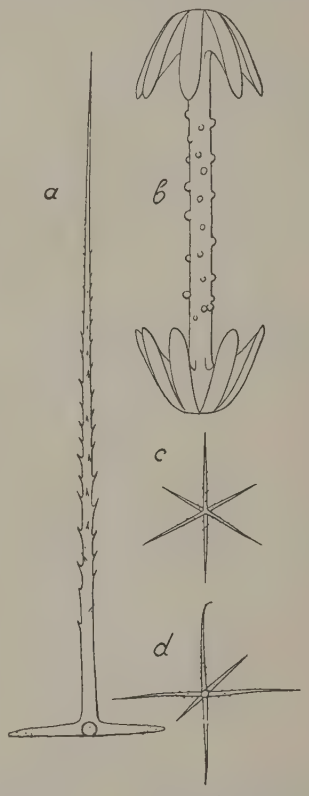
Specimen G. — (Textfig. 13). From Stat. 161, between Kofiau Island in Halmaheira Sea and the western corner of New Guinea. A much injured specimen of a hazelnut size, 31 mm. long, with root-tuft broken off close to origin. The sponge must have originally looked very

much like specimen D. At the upper end there projects the gastral cone, on one side of which there seems to have existed the osculum, leading into the moderately deep gastral cavity.

Dermal pinules (textfig. 13, *a*) 230—340 μ, on an average 300 μ, long; rhachis 6 or 7 μ thick at base, finely attenuated at distal end, with small spines; basal rays about 30 μ long. — Gastral pinules scanty, 165—100 μ or shorter, gradating over to canalaria in which the free ray may be only 50 μ long. — Hypodermal oxypentactins with rays which may reach a little over 500 μ in length and 65 μ in basal thickness. — Choanosomal megascleres consisting of rhabdoxydiactins and macroxyhexactins as usual. Some of the former are tignules which may be 8 mm. long and 300 μ thick in the middle. The latter, numerously present, are of various strenght, reaching up to 6 mm. in axial length and 200 μ in basal thickness of rays. The strong development of these spicules is noteworthy in view of the small size and the immature state of the sponge. — Basal needles with terminal anchor, 6—7-toothed and 150—190 μ broad. — Microxyhexactins (*c*, *d*) common in gastrosome, 50—90 μ in axial length; the rays up to nearly 4 μ thick at base, rough or sparsely spinulate, commonly straight but not infrequently (either all the six rays or some of them) curved more or less at the outer end. Exceptionally the spicule is pentactine, apparently grading over to canalaria. — Macramphidisc (*b*) common in dermatosome, generally 360—400 μ long and 130—150 μ broad; exceptionally as small as 275 μ × 88 μ; umbel length between $^1/_3$ and 0.25 of the entire length, with 8 lanceolate teeth; axial shaft thick, up to 33 μ across, with a rather sparse number of tubercles on surface. — Mesamphidisc sparsely present in both dermatosome and gastrosome; 88—120 μ long, 30—40 μ broad; umbel longer than $^1/_3$ the entire length. — Micramphidiscs numerous in dermatosome, scanty in gastrosome, 20—13 μ long.



Textfig. 13. — *Hyalonema* (*Cyliconema*) *apertum maehrenthali* F. E. Sch. Specimen G, from Stat. 161.
a dermal pinule. *b* macramphidisc. *c* microxyhexactin. *d* ditto, all rays bent at end.
Fig. *b* × 150; other figures × 300.



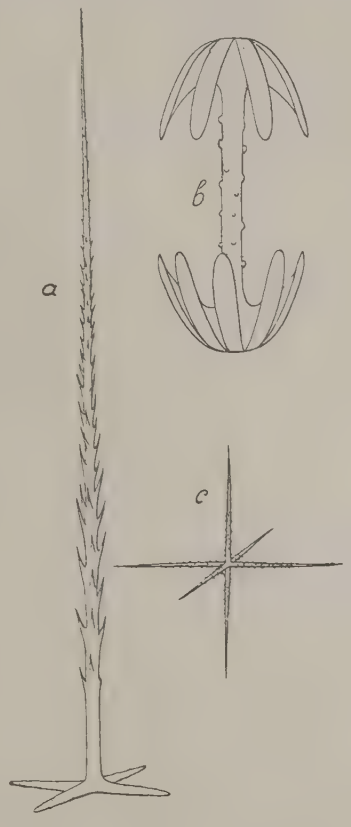
Textfig. 14. — *Hyalonema* (*Cyliconema*) *apertum maehrenthali* F. E. Sch. Specimen I, from Stat. 137.
a dermal pinule. *d* ditto, with all but one rays bent at end.
b macramphidisc.
c microxyhexactin.
Fig. *b* × 150; other figures × 300.

Specimen H. — From Stat. 145 in Halmaheira Sea. A small fragmentary specimen which must have measured not more than 20 mm. in length of body. The spiculation closely agrees with that of the foregoing specimen. Suffice it to mention: Dermal pinules 220—300 μ long. Gastral and canalar pinules not discovered. Choanosomal macrohexactins numerous, but not so strongly developed as in G. Microxyhexactins 50—61 μ in axial length; rays straight,

sometimes curved at end; spinules on them usually retroverted. Macramphidisc 250—330 μ long. Mesamphidisc sparsely present, small.

Specimen I. — (Pl. IV, fig. 8, Textfig. 14). From Stat. 137, a spot near Ternate, off the western coast of Halmaheira or Djilolo. A small ovoid specimen, 16 mm. long and 10 mm. broad, with incomplete root-tuft surrounded at origin by 2 or 3 *Palythoa* polypes in a ring (Pl. IV, fig. 8). At the upper pole an oval osculum of 3 mm. length; the upper end of columella not free, but still adherent to gastral wall on one side. Dermal surface much as in specimen F, with about 0.5 mm. wide rectangular meshes to hypodermal lattice.

Dermal pinules (textfig. 14, *a*) again quite like those of F; 250—350 μ (mostly about 320 μ) long, 7 μ thick at base; basal rays 30—42 μ long. — Gastralia not yet differentiated from canalaria, which are sparse in number and small with rays 100 μ or less long. — Hypodermalia almost entirely oxypentactins with paratangentials reaching up to 0.75 mm. length and 50 μ basal thickness. — Without tignule among choanosomal rhabdoxydiactins, but there occur a large number of macroxyhexactins in the choanosome. These are of various sizes up to such as have longest axis 3 mm. long and rays 100 μ thick at base. — Microxyhexactins (*c*, *d*) fairly common, generally 60—90 μ in axial length; the rays up to 3 μ thick at base, usually quite straight but occasionally gently bent at end, rough-surfaced on account of low microtubercles; these sometimes spinule-like. The same spicule is exceptionally pentactine and thus seems to be linked to the canalaria. — Macramphidiscs (*b*) numerous in dermatosome, 320—460 μ, commonly 380—430 μ long; umbel 120—140 μ broad, about 0.25 as long as the entire spicule, with 8 teeth, rounded or obtusely pointed at end; tubercles on axial shaft not forming a distinct whorl in the middle. — Mesamphidiscs numerous at places, 100 μ × 30 μ or smaller; umbel longer than $^1/_3$ the entire spicular length; leading over to micramphidiscs of 15 μ length.



Textfig. 15. — *Hyalonema* (*Cyliconema*) *apertum maehrenthali* F. E. Sch. Specimen J, from Stat. 208. *a* dermal pinule, × 300. *b* macramphidisc, × 150. *c* microxyhexactin, × 300.

Specimen J. — (Pl. II, fig. 15. Textfig. 15). At Stat. 208, near Munai Island at the south-eastern corner of Celebes, were obtained two small specimens which are here provisionally referred to *H. apertum maehrenthali*. One of them is a small, macerated fragment and was examined only so far as to give me the conviction of its being identical in spiculation with the other specimen. The latter (specimen J, pl. II, fig. 15), which was chiefly studied, has the body of an elongate ovoid shape, 26 mm. long and about half as broad in the middle. A roundish osculum of 3 mm. diametre open at the upper rounded end. Within it are discernible the central gastral cone and the apertures of some subcentral excurrent canals. There exists no sign of a developing sieve-plate. The root-tuft is broken off at origin, which is surrounded by a beginning *Palythoa* colony. The external surface shows the usual hypodermal lattice with small and moderately regularly rectangular meshes of $^1/_3$—0.5 mm.

width. Beside the meshes, there are seen some number of freely open roundish perforations, not larger than 0.75 mm. across.

Dermal pinules (textfig. 15, *a*) remarkable for the unusually great length they attain; the rhachis 330—440 μ long, 7 μ thick at base, distally finely attenuated, provided with moderately well developed and obliquely set lateral spines, which may be 10 μ long, as measured on the inner side. Basal rays 40—50 μ long, gradually narrowing to the pointed end, sparsely and obsoletely microtubercled. The dermalia stand pretty close together in rather broad tracts over hypodermal beams. — Gastral and canalar pinules were not discovered in both the specimens, owing no doubt to their young state.

Hypodermal megascleres entirely macroxypentactins with paratangential rays, reaching up to 600 μ in length and 34 μ in basal thickness. — Choanosomal megascleres chiefly rhabdoxydiactins, generally under 1.7 mm. length and 20 μ thickness in the middle. None of them are as yet developed into tignules. Together with them there occasionally occur macroxyhexactins under 1 mm. axial length and with rays up to 17 μ thick at base. The same spicule is sometimes found in the pentactine form.

Microxyhexactins (*c*) numerous in choanosome. The same spicule frequently occur in the pentactine form (microxypentactin). Axial length generally 75—115 μ, sometimes as long as 140 μ; with rays up to 4 μ in basal thickness, always perfectly straight, and rough-surfaced on account of minute conical tubercles, numerously present.

Macramphidisc (*b*) not abundant, though common at places in the dermatosome; 225—375 μ long and 100—154 μ broad; umbel semiovoid, generally about $^1/_3$ as long as the entire spicule, with 7 (sometimes only 6) teeth which are lanceolate in outline but rounded at end; axial shaft 17—23 μ thick, with rounded tubercles which generally do not form a whorl around the middle. Measurements of some representative macramphidiscs as follows:

Total length	Umbel length	Umbel breadth
225 μ	80 μ	115 μ
240 μ	—	100 μ
297 μ	100 μ	110 μ
297 μ	100 μ	143 μ
340 μ	110 μ	130 μ
352 μ	110 μ	154 μ
352 μ	120 μ	154 μ
374 μ	130 μ	154 μ

The fact that the umbel length is approximately equal to $^1/_3$ the length of the whole spicule gives to the macramphidisc, but especially to the larger ones of it, a relatively broader appearance than the same spicule of *H. apertum apertum* or of any of the specimens I have referred to *H. apertum maehrenthali.*

Mesamphidiscs sparsely found in the gastrosome, very rarely in the dermatosome; small, up to 42 μ × 14 μ, similarly characterized as the same spicule of *H. apertum* in general, but with the umbel usually distinctly longer than $^1/_3$ the length of the whole spicule. — Micramphidiscs 17—15 μ long.

The most remarkable features in the spiculation of the above specimen from Celebes consist in the relative shortness of the macramphidisc in proportion to the length of its umbels

and in the great length attained by the dermalia. In these regards the specimens seem to deviate from all the others I have referred to *maehrenthali*. However, it may be doubted if on that account they can be made the type of a distinct form.

In the following table I have put together the more important features of the specimens recorded above.

Specimen	Locality	Body length in mm.	Dermalia length in μ	Gastralia length	Microxyhexactin	Macramphidisc length	Mesamphidisc length
A	Stat. 316. Java Sea.	100	320—365	440—500 μ. (Very densely crowded).	75—90 μ axis length. Rays straight or bent.	270—385 μ	42—65 μ. (Numerous in canalar wall).
B	Stat. 314. Java Sea.	40	190—250	200—380 μ. (Crowded).	46—100 μ axis length. Rays straight or bent.	240—300 μ	42—53 μ (Numerous in canalar wall).
C	Stat. 52. Between Flores and Sumba.	31	175—230	Up to 240 μ. (Probably not yet fully developed).	60—100 μ axis length. Rays straight.	270—400 μ	Up to 70 μ. (Numerous in gastral and canalar wall).
D	Stat. 254 Kei Islands.	35	220—350	(Not differentiated from canalaria).	40—55 μ axis length. Rays straight.	240—350 μ	Up to 60 μ, rarely 150 μ. (Common in dermatosome and gastrosome).
E	Stat. 251. Kei Islands.	36	190—220	Up to 130 μ (Sparse, probably in development).	60—85 μ axis length. Rays rarely bent.	300—385 μ	Rarely 130 μ, mostly much shorter. (Rather sparse).
F	Stat. 173. E. end of Ceram.	12	320—400	(Not observed).	53—80 μ axis length. Rays occasionally bent.	Usually 340—380 μ. Occasionally 220 μ or less.	45—120 μ (Not numerous).
G	Stat. 161. Halmaheira Sea.	31	230—340	165—100 μ or shorter. (Probably in development).	50—90 μ axis length. Rays sometimes bent.	360—400 μ	88—120 μ. (Sparse).
H	Stat. 145. Halmaheira Sea	20	220—300	(Not discovered).	50—61 μ axis lenght. Rays straight or bent. Spinule usually retrovert.	250—330 μ	Small. (Sparse).
I	Stat. 137. W. coast of Halmaheira.	16	250—350	(Not differentiated from canalaria).	60—90 μ axis length. Rays sometimes slightly bent.	320—460 μ	Up to 100 μ. (Numerous at places).
J	Stat. 208. S. of Celebes.	18 and 26	330—440	(Not discovered).	75—140 μ axis length. Rays straight. Frequently pentactine.	222—375 μ. (Umbel relatively broad, about $^1/_3$ as long as the spicule, usually 7-toothed).	Up to 42 μ. (Sparse).

Remarks. — *H. maehrenthali* was first put forward as a distinct species by F. E. Schulze in 1895, though at the same time it was held by him to be possibly identical with *H. apertum*. It was based on twelve small specimens (12—45 mm. body length) collected by the "Investigator" in the neighbourhood of Andaman Islands. The describer laid emphasis on the considerably longer dermalia and the greater average length of the macramphidisc in *H. maehrenthali* than in *H. apertum*, while in other points of organization the two forms were regarded to be essentially alike. On account of those differences, and in the absence of any evidence that the same kind of spicules in a species may be better developed in young individuals than in full-grown,

it was considered admissible that the small specimens in question were not the young of *H. apertum*, but were to be specifically distinguished from this. Hence, the name *H. maehrenthali* was given them. This position was however relinquished later by F. E. Schulze (1899 *b*, 1902), and the same specimens were declared to be simply the young of his *H. affine reticulatum*, a subspecies which he instituted in distinction from his *H. affine japonicum*. Amongst other points it was now stated in effect (1899 *b*, p. 128), that the prolonged height of dermalia in the specimens referred to stands in relation to the immature state of these. The inference is that the dermalia grow shorter or become replaced by shorter ones as the sponge grows older, — a fact which, to my kwowledge, has never yet been demonstrated. Be that as it may, F. E. Schulze subsequently declared in the "Valdivia" Report (1904), that his distinction of *H. affine* into two subspecies, *japonicum* and *reticulatum*, is untenable and must be given up. At the same time, having recognized the inadmissibility of the specific name *affine*, he returned to calling the species by the next available name of *H. apertum*. *H. maehrenthali* has since stood thrown together with *H. apertum*, without any distinctive status having been assigned to it under that species.

Now, the discovery, in the "Siboga" collection, of several large and small specimens from different localities, which seem to be more readily referable to *maehrenthali* than to the typical *apertum*, while none, satisfactorily referable to the latter, are represented, gives an impression that the two forms are differentiations with different range of geographical distribution. This has led me to think that *maehrenthali* may, with advantage, be kept up in the system, though, in view of the extreme variability of characters in both the forms and of the existence of individuals wellnigh intermediate in characters, no more than subspecific distinction should probably be made between the two.

According to F. E. Schulze (1895, p. 43), the original specimens of *H. maehrenthali* had dermal pinules at least 200 μ and on an average 300 μ-long, and macramphidiscs almost always over 200 μ in length. Further, they seem to have possessed echinated microxyhexactins with bent rays in a less number than in typical *H. apertum*, and small mesamphidiscs of 30—50 μ length in pretty frequent occurrence (1899 *b*, p. 128).

Now, in most of the "Siboga" specimens (A, D, F—I), the dermalia length may be looked upon to agree pretty well with that given by F. E. Schulze from his specimens of *H. maehrenthali*. It is in most cases decidedly and very considerably longer than is known to me from any specimen of typical *H. apertum*. In the three specimens B, C and E, the dermalia length is on the whole much shorter than in the rest of the "Siboga" specimens, although the longest dermalia in each are fully as long as the shortest in some of the latter. It nearly approaches that in certain individuals of typical *H. apertum*, but still keeps up a standard of length (200 μ at least), which is longer than in most individuals of that form. The question if the dermalia length in the three "Siboga", specimens just referred to, will not increase with further growth of the sponge, I am decidedly inclined to answer in the negative. For, small as those specimens are, they are already of a size in which the dermalia, accordingly to my experience, must have long since attained the shape and dimensions they present in the adult, as are likewise all the other small specimens (D, F—J) with longer dermalia. In fact, I believe that in the matter of dermalia length there exist all sorts of gradual variation, connecting *maehrenthali* with typical *apertum*. — In the "Valdivia" Report F. E. Schulze has reported on

some small *Hyalonema* specimens from the south-west coast of Sumatra (near Paget I. and Nias I.), referred to *H. apertum* by him and in which the dermalia were only 120—150 μ long or longer, while the macramphidiscs were about 300 μ large. This may probably be a case of an intermediate form between *maehrenthali* and typical *apertum*, in which the dermalia length falls well within the range shown by average individuals of the latter, but the macramphidisc occurs in a size agreeing with that of same in the former. As a case of variation, reciprocal to the above, so to say, may perhaps be regarded the specimen F of the "Siboga" collection, in which the dermalia measure 320—400 μ long, while the macramphidisc falls in minimum length down to 220 μ, or even to 120 μ, should the large macramphidisc-like mesamphidisc (textfig. 12, *c*), observed in the specimen, be classed with the macramphidisc.

As regards the gastral pinules, their remarkably strong development and densely crowded occurrence in specimen A constitute a very noteworthy feature. They are there incomparably longer than is known from typical *apertum*. Moreover, they are all much longer than the longest dermalia in the selfsame body, a state of things which also never has as yet been observed in typical *apertum*. Specimens B and C possess gastralia of a considerably shorter length than in A, probably in relation to the comparatively short dermalia of those specimens; but even then, there is unmistakeably observable in both the tendency of the gastralia to outrun the dermalia in length. The rest of the "Siboga" specimens are all in too young a state to exhibit gastrals in their definitive condition; these are here either not yet developed or still insufficiently differentiated in relation with the gastral cavity and osculum themselves, being in an early stage of development. F. E. SCHULZE gave no notice of gastral pinules, probably for the reason that they were not sufficiently differentiated in his specimens to have attracted attention, as they factually are not in the smaller "Siboga" specimens.

With respect to the supporting megascleres, it may be mentioned that both hypodermal macropentactins and choanosomal macrohexactins, in their numerical proportion to rhabdodiactins, are found in greater relative abundance in young than in old individuals. It appears that, as the sponge advances in growth, the rhabdodiactins increase in number more rapidly than the macropentactins and the macrohexactins, and that more especially in the choanosome; the result being that in large individuals, as f. i. in specimen A, the hypodermal beams show a large contingent of rhabdodiactins in their composition, while in the choanosome macrohexactins are found but rarely, in comparison to rhabdodiactins. I have arrived at just the same conclusion from my studies on *H. apertum apertum* of Japan.

Of the intermedial microhexactins, a noteworthy fact is that in the two small specimens C and D, not a single bent-rayed one but only those with straight rays were met with. I greatly doubt if any systematic significance can be attached to that fact in those specimens, when it is considered that in some other small specimens (f. i., in E) the bent-rayed form occurs together with the straight-rayed, the bending of rays in the former being not infrequently carried out to but a very feeble degree and not always simultaneously in all the six rays of one and the same spicule. It may be that microxyhexactins, that appear first in young individuals of the species are straight-rayed ones, to which subsequently, sooner or later, bent-rayed ones become added. The manner in which the spinules on the rays are directed, is, so far as can be judged, a very variable matter which cannot be made use of in the systematic.

The macramphidisc in the "Siboga" specimens of *maehrenthali* I have found to be at least 240 μ long (excepting the isolated case of specimen F) and to reach 300—400 μ or even 460 μ in maximum length. It cannot but be said to be on the average distinctly larger than in typical *apertum*, in which the length ranges from a maximum of 350—200 μ down to 150 μ or less.

The mesamphidisc, which is subject to much variation in the range of its size in different individuals but probably always passes over insensibly into the micramphidisc, occurs in all the specimens. The appearance is that it comes to be present in very great abundance in canalar wall, as the sponge approaches maturity. — The micramphidisc seems to present no features of systematic importance.

6. *Hyalonema* (*Cyliconema*) *timorense* n. sp. (Plate II, fig. 16. Textfig. 16).

Stat. 284. 8°43′.1 S. 127°16′.7 E. 828 m. 1 specimen.

Diagnosis. — *Cyliconema* known in a single small specimen. Dermal pinule 230—365 μ (on an average 300 μ) long. Microxyhexactin fairly common, 150—240 μ in axial length, with straight and nearly smooth or faintly rough rays. Macramphidisc mostly 550—715, with axial shaft smooth throughout and semiovoidal umbel broader than long, about as long as 0.25 the length of entire spicule or shorter, made up of usually 8 (exceptionally 9 or 10) lanceolate teeth. Mesamphidisc of two sorts: large mesamphidisc of ovoid shape, 143—110 μ long, each umbel with 10—14, relatively broad teeth which reach quite or nearly to the equator; small mesamphidisc of much rarer occurrence, elongate-ovoid, 50 μ × 15 μ and less, the umbel being a little longer than $^1/_3$ the length of entire spicule.

Description. — The type of this new species comes from Stat. 284, a spot off to the south of the eastern end of Timor. It is a tiny, and therefore presumably a very young individual (pl. II, fig. 16). The swollen spindle-like body is about 13 mm. in length and 4 mm. in maximum breadth at the middle. It is injured at both ends, so that the exact condition of the osculum and gastral area cannot be stated. A slender, non-twisted root-tuft is given out from the narrowed basal end; it consists of a few slender needles up to 50 mm. long and 100 μ thick, all broken off at the inferior end. The external surface of the sponge, on close observation, shows a finely tessellate structure, due to the delicate hypodermal lattice.

Spiculation. — The dermal pinule (textfig. 16, *a*) has the rhachis generally 230—365 μ (on an average 300 μ) long, slender, not thicker than 6 μ at base, thence tapering to the finely drawn out end; short-spiny with feebly developed spines, not more than 6 μ long on the inside. Basal rays rather long, 60—80 μ in length, gradually tapering to the pointed end, rough-surfaced on account of the presence of minute conical tubercles. — Both gastralia and canalaria could not be distinguished.

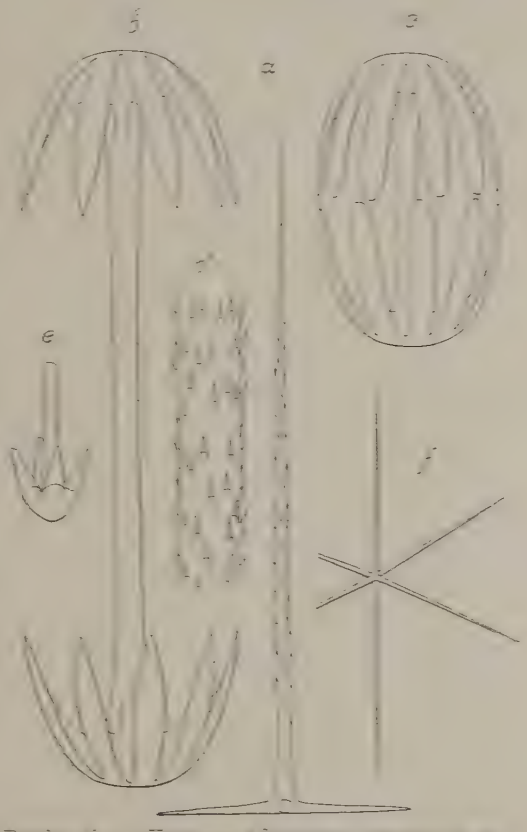
Hypodermal megascleric elements are mainly oxypentactins, with which rhabdodiactins, similar to those of the choanosome, are associated in a small number to form hypodermal threads. The pentactins reach a size in which the straight paratangentials may be 330 μ long by basal thickness of 13 μ, the proximal ray being about as long or much longer.

Choanosomal megascleres consist of rhabdoxydiactins and macroxypentactins, both with

rays smooth throughout. The diactins are as a rule small, with or without a central annular swelling. Occasionally they are developed into tignules of 4.5 mm. × 70 μ or of a somewhat larger size. The hexactins occur in abundance. They have straight rays running up to 500 μ length and 15 μ thickness at base. The smaller of the hexactins may possibly pass over insensibly to the microxyhexactins. — The microxyhexactin is fairly common. It is of a relatively large size, measuring 150 μ—240 μ or thereabout in axial length; the rays are slender, being only about 3 μ thick at base, faintly rough or nearly smooth throughout, and always straight or nearly so.

The basal fibres show, in their thickest parts (100 μ thick), the unusual appearance of the numerous small spines being singly scattered over the shaft surface, instead of being arranged, as usual, in an interrupted spiral row (textfig. 16, *d*). The spines are 23—27 μ long, as measured on the inside. In the more distal and thinner parts (35 μ or thereabout in thickness) of the fibres, or in the thin and adolescent fibres, still entirely contained in the columella, the spines present an appearance of forming irregular whorls at intervals of 70—100 μ, rather than that of being arranged in a more or less continuous spiral line. — A case of the terminal anchor, discovered in the columella, exhibited four broad and well-developed teeth of unequal length (*e*).

Macramphidiscs (*b*) occur numerously in the choanosome. They are of a remarkably large size, mostly measuring 500—715 μ, rarely 495 μ, in length. The umbel is semiovoidal, broader than long, 160—200 μ broad and of a length equal to about 0.25 the entire length of the spicule or slightly shorter than that; with lanceolate and acutely pointed teeth, usually 8 and exceptionally 9 or 10 in number to each umbel. The axial shaft is 23 μ thick, cylindrical, without tubercles and smooth throughout, very rarely with an indication of an annular swelling around the spicular centre. Measurements of the spicule as follows:



Textfig. 16. — *Esperiopsis* (*Esperiopsis*) *simplex* n. sp.
a dermal pinule. *e* terminal anchor of basal fibre.
b macramphidisc. *f* microxyhexactin.
c large mesamphidisc.
Figs. *a*, *c*, *f*, × 300; fig. *b*, × 150; figs. *d*, *e* 100.

Entire length	Umbel length	Umbel breadth
495 μ	120 μ	160 μ
550 μ	130 μ	176 μ
560 μ	132 μ	187 μ
583 μ	143 μ	192 μ
583 μ	150 μ	180 μ
600 μ	154 μ	160 μ
649 μ	122 μ	170 μ
715 μ	165 μ	200 μ

Mesamphidiscs occur in two kinds, large and small. The large mesamphidisc (*c*) is common subdermally as well as in the deeper parts. It greatly resembles in appearance the peculiar spherical or nearly spherical mesamphidisc variety that was described and figured by F. E. Schulze (1904) from *Hyalonema globiferum*. In the present species the spicule is exquisitely ovoid in shape, measuring 143 μ × 90 μ—110 μ × 75 μ. The umbel, composed of 10—14, relatively broad teeth rounded or obtusely pointed at end, reaches quite or nearly to the equator, so that the teeth of the two opposite umbels come nearly into touch with their ends, which alternate in their position and thus do not actually fuse together. The axial shaft is smooth. — The small mesamphidisc was met with but very rarely. It is of the usual elongate-ovoid shape, measuring not more than 50 μ × 15 μ in size. The umbel length is a little longer than $^1/_3$ the length of the whole spicule.

Micramphidiscs of the usual shape and appearance, 20—15 μ long, occur in a rather sparse number.

Remarks. — The presence, in the present species, of the peculiar ovoid mesamphidisc with umbels which reach to the equator, at once suggests its affinity to *Hyalonema* (*Cyliconema*) *globiferum* F. E. Sch. (1904), known from the Bay of Bengal. In fact, the two species seem to be very nearly related forms, the difference between them being almost limited to this, that in *H. globiferum* the dermal pinule (in average 160 μ long) and the macramphidisc (400—600 μ long) are both markedly shorter or smaller. It may further be pointed out that, while in that species the macramphidisc has the axial shaft usually smooth but occasionally provided with a sparse number of tubercles, the same in *H. timorense* never shows the tuberculation. It may be doubted if the above differences are sufficient for the specific distinction. Perhaps it may be that *timorense* deserves being made only a subspecies or variety of *globiferum*.

According to v. Lendenfeld (1915, p. 151), *H. globiferum* can be taken up in his subgenus *Oonema* solely on account of the large ovoid mesamphidisc, above referred to. If we take that step, *H. timorense* must of course be referred also to that subgenus. However, I have chosen to place the two species in question under *Cyliconema*; because, by so doing, the necessity of separating them subgenerically from such species (f. i., *H. ovatum*, *H. rapa*) as show especially close affinity to them, but are without the above-named ovoid mesamphidisc, is disposed of; while, on the other hand, a greater homogeneity of character seems to accrue to the subgenus *Oonema* by excluding forms with short-spiny, whip-like dermalia from amongst all the rest, which have robustly developed and strongly spiny dermalia. It may simply be so regarded that the two subgenera come into approach to each other with respect to the shape of certain amphidiscs.

As above indicated, *H. ovatum* Ij. (1894), *H. rapa* F. E. Sch. (1900, 1904) and *H. globiferum* F. E. Sch. (1904) seem to be very nearly related allies of *H. timorense*. Nearly equally close appears to be the affinity between this species and *H. keiense*, the latter another new species to be next described. Probably the five species here mentioned may be regarded as constituting a relatively coherent assemblage under the subgenus *Cyliconema*.

7. *Hyalonema* (*Cyliconema*) *keiense* n. sp. (Textfig. 17).

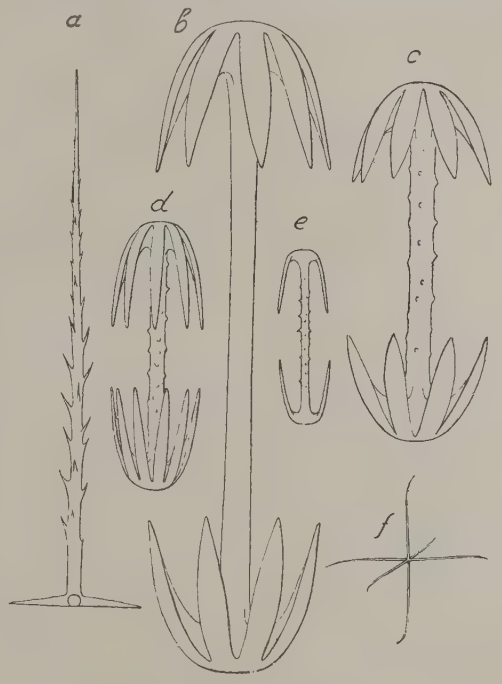
Stat. 253. 5° 48′.2 S. 132° 13′.0 E 304 m. Fragments.

Diagnosis. — *Cyliconema* of unknown body shape. Dermal pinule 220—300 μ long.

Microxyhexactin under 100 μ axial length, with slender, nearly smooth rays almost straight or gently bent near end. Macramphidiscs in two sorts: large macramphidisc 695—440 μ long and much like the macramphidisc of *H. timorense*; and small macramphidisc 363—286 μ long, with umbel 140—112 μ broad and about $^1/_3$ or somewhat less than $^1/_3$ the length of the whole spicule. Mesamphidisc numerous, elongate-ovoid in shape up to 187 μ × 60 μ in size, the umbel being usually slightly longer than $^1/_3$ the entire spicule length.

Description. — As basis of this species have served some small fragments which I have extricated from among the rooting fibres of *Pheronema weberi* n. sp., obtained at Stat. 253, near Taam Island, one of the Kei Islands. Nothing can be said of the shape and size of the sponge, of which the fragments were originally parts. From the strong development of certain megascleres, the assumption seems permissible that we have here to do with an individual well advanced in growth.

Spiculation. — The dermal pinules (textfig. 17, *a*) look essentially like those of the last described species, though appreciably stronger in the development of rhachis and shorter in the length of basal rays. Pinular ray 220—300 μ long, almost invariably broken off at apical end, about 8 μ thick at base; basal rays 38—42 μ long. Small and weakly developed pinules with pinular ray 130 μ or less long and basal rays about 50 μ long, met with in a few number in the preparations, are probably to be looked upon as the canalaria.



Textfig. 17. — *Hyalonema* (*Cyliconema*) *keiense* n. sp.
a dermal pinule. *d*, *e* common forms of mesamphidisc.
b large macramphidisc. *f* microxyhexactin.
c small macramphidisc.
Figs. *a*, *d*, *e*, *f*, × 300; figs. *b*, *c*, × 150.

Hypodermal oxypentactins have paratangentials generally up to 275 μ long and 20 μ thick at base; the proximal ray longer than paratangential in one and the same spicule. Larger and stronger oxypentactins with rays frequently over 1 mm. length and often of an irregular shape with bent rays, were met with in certain teased preparations, but I am doubtful if they really belonged to the specimen in question and not to *Pheronema weberi*; there existing at some other places unmistakeable signs of the mixing up of tissues from both sponges.

Choanosomal macrohexactins I have not been able to observe with certainty; this may have been due simply to their relative paucity after full growth of the sponge, a fact I am familiar with in the case of *H. apertum apertum*. The rhabdoxydiactins are well developed. They are generally under 30 μ thick, but are occasionally developed into spindle-shaped tignules which may be 5 mm. long by a thickness of 250 μ in the middle.

Microxyhexactins (textfig. 17, *f*) were discovered in subdermal positions after a long search, and then in quite a limited number. They are small, measuring 65—85 μ in axial length, with slender and nearly smooth rays either gently bent near end or nearly straight throughout.

Macramphidiscs occur in abundance; they are divisible into the large and the small kind. The large macramphidisc (*b*) compares almost exactly with the macramphidisc of *H. timorense* in both size and appearance, except in having relatively somewhat deeper umbels. Length 695—440 μ, mostly over 590 μ; umbel semiovoid, about 0.25 or less than 0.25 the length of the whole spicule, with 8 (sometimes 9 or 10) lanceolate teeth, acutely pointed at end; axial shaft 30—22 μ thick, cylindrical, always smooth throughout, without even an indication of the central annular swelling. This macramphidisc kind seems to be confined in its occurrence to the choanosome. Measurements of some large macramphidiscs as follows:

Entire length	Umbel length	Umbel breadth
695 μ	165 μ	210 μ
660 μ	155 μ	160 μ
610 μ	154 μ	170 μ
550 μ	143 μ	180 μ
484 μ	132 μ	165 μ
440 μ	120 μ	143 μ

There was once observed an abnormally developed case of the large macramphidisc (about 630 μ long) in which there existed four half-shafts, arising from the common centre and each capped with an umbel of a rather irregular shape. The half-shafts did not lie in a plane. The spicule was in fact an irregularly developed tetradisc.

The small macramphidisc (*c*) measures 363—286 μ in length and 140—112 μ in breadth, the umbel length being equal to about $^1/_3$ the length of the whole spicule or somewhat shorter. Teeth lanceolate, sharply pointed, always 8 in number to each umbel. This kind of macramphidisc differs from the last not only in size and proportion of parts, but also in having the 19—22 μ thick axial shaft invariably tuberculated. The tubercles are more conical than rounded, rather sparse in number, and are scattered on the surface without forming a whorl in the middle of shaft. To this kind belong all the macramphidiscs that occur in the dermal layer in vertical orientation to its plane. Measurements as follows:

Entire length	Umbel length	Umbel breadth
363 μ	110 μ	135 μ
352 μ	90 μ	140 μ
340 μ	104 μ	130 μ
320 μ	100 μ	132 μ
308 μ	85 μ	122 μ
286 μ	100 μ	112 μ

Mesamphidiscs (*d*, *e*) are numerously present. They are of all sizes, from largest of 187 μ × 60 μ down to those of 40 μ length. The shape is generally elongate-ovoid, the breadth being equal to about $^1/_3$, seldom to nearly 0.5 or 0.25, the length of the whole spicule. The deeply bell-like umbel, with 10 or more teeth, may be about $^1/_3$ as long as the whole spicule, but is more usually distinctly longer than that. The nearest approach to the peculiar spherical or ovoidal mesamphidisc form of *H. globiferum* and *H. timorense*, is presented, in the present species, by those very rarely met with, which, by 100 μ length, have each umbel about 45 μ long as well as broad, and in which therefore the opposite umbels are separated from each other by an equatorial space of a width, equal to about $^1/_{10}$ the entire length of the spicule.

Micramphidiscs about 20 μ long, much less numerously present than mesamphidiscs.

Remarks. — The spiculation, as it could be made out from the fragments, shows a decided resemblance to that of *H.* (*Cyliconema*) *timorense* and its near congeners, yet is different enough to assume the specific distinctness from any of these. For the forms which seem to be especially nearly related to this species, see the remark under *H.* (*C.*) *timorense.*

8. *Hyalonema* (*Paradisconema*) *vosmaeri* n. sp. (Plate III, figs. 11, 12. Textfig. 18).

Stat. 256. 5° 26'.6 S. 132° 32'.5 E. 397 m. 1 specimen.

Diagnosis. — Body shaped like a moderately large, thick-walled cup with outflaring rim; without sieve-plate or a continuous gastral covering. Hypodermal lattice formed of fine and delicate threads, irregularly meshed. Dermal pinule with moderately strongly spiny free ray of a slender poplar-tree-like appearance, 160—175 μ (sometimes up to 210 μ) long. Gastral pinule similar to dermal but somewhat more strongly developed and on the whole longer, the free ray measuring generally 190—247 μ long. Canalar pinule similar to gastral but frequently very much taller, up to 470 μ high. Choanosomal megascleres exclusively slender rhabdodiactins, generally less than 2.5 mm. long; without macrohexactin. Microxyhexactin numerous, with smooth and either straight or gently curved rays, 60—95 μ in axial length. Macramphidisc numerous in all parts of body, exceedingly variable in size, measuring 187—781 μ long; with hyperbolic umbel, composed of 8 lanceolate teeth, its length varying between $^1/_5$ and $^1/_3$ that of the whole spicule; axial shaft with a varying number of scattered tubercles. Mesamphidisc rare, 30 μ long. Micramphidisc common, 20—12 μ long, rarely occurring in the form of paradisc.

Description. — The only specimen (pl. III, figs. 11, 12) of this new species has come from Stat. 256 among the Kei Islands. It is a large fragment representing the upper parts of a sponge body, which, when entire, must have been of the shape of an inverted cone or of a thickwalled cup with the marginal zone expanded outwards like a trumpet. The height of the body cannot be told, because of the lack of the lower parts. Seen from above, the gastral area is of an irregularly oval-like outline, 107 mm. long and 79 mm. broad. The middle of that area is irregularly depressed. How deep this depression was, or if there existed a central cone, cannot be determined owing to injuries done to the central parts which were torn off and lost together with the lower parts and the entire basal tuft. The peripheral parts of the gastral area present all around a roundedly convex surface. A continuous gastral layer covering up the postical orifices does not exist. The marginal parts of the sponge wall remain thick and swollen-like to the very rim, which is marked by a thin and narrow, but continuous cuff-like fringe of marginalia. This fringe is only 1 mm. or thereabout in width, and is directed more or less downward in continuation of the plane of convexity of the gastral surface in the marginal zone.

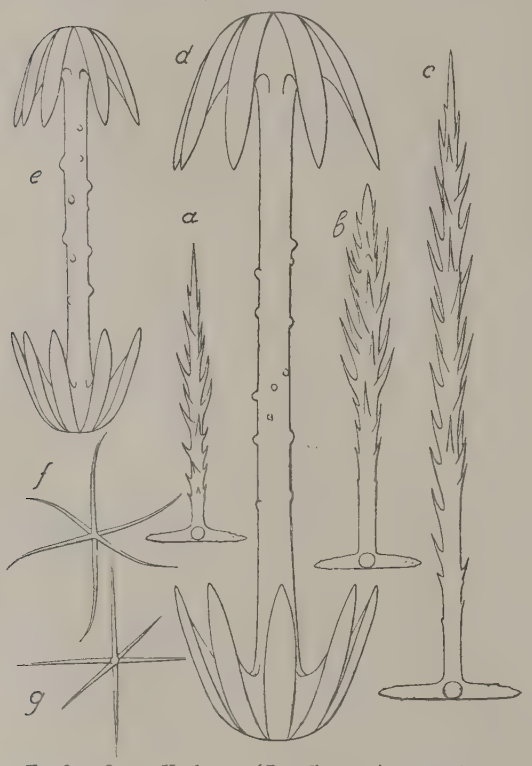
The dermal surface shows the cribellate dermal membrane of an extreme fineness. The hypodermal lattice is delicately structured, being made up of very thin intersecting threads. Its meshes are quite irregular in shape, measuring generally 1—1.5 mm. across. The ostia of incurrent canals, visible through the thin dermal layer, are of various sizes under 2 mm. diametre.

On the gastral surface there freely open numerous minute as well as large postica or

apertures of the excurrent canal-system. The larger of the apertures, which may reach 10 mm. by 5 mm. in size, occur in the peripheral parts of the exposed gastral surface. The interspaces between the apertures present a finely granular and at the same time a more or less porous appearance, besides indistinctly revealing the intersecting hypogastral threads of a fine calibre.

The sponge in the wet state is very soft, so that it required some care in lifting it out of the alcohol without fear of breaking off by its own weight.

Spiculation. — The dermal pinule (textfig. 18, *a*) has the free ray shaped like a slender poplar-tree or an elongate spindle (together with spines), generally 160—175 μ, sometimes up to 210 μ, long and not more than 25 μ broad in the broadest parts. The rhachis is about 7.5 μ thick at base, not noticeably thicker in the middle parts, drawn out to a fine point at the end, less frequently ending with a somewhat conical tip. The lateral spines are not very numerous; they are moderately well developed, being longest in the middle parts of the rhachis, where they may reach up to 23 μ in length. They grow shorter towards both ends of the rhachis, leaving the distal end of this freely projecting. The basal rays are 30—35 μ long as measured from the spicular centre, and slightly thinner than the rhachis at base. They are conically pointed at the outer end, and show a few spine-like microtubercles on surface.



Textfig. 18. — *Hyalonema* (*Paradisconema*) *vosmaeri* n. sp.
a dermal pinule. *d* large macramphidisc.
b gastral pinule. *e* small macramphidisc.
c medium-sized canalaria from near the aperture of an excurrent canal. *f*, *g* two microxyhexactins.
Figs. *d*, *e*, × 150; all other figures × 300.

The gastral pinule (textfig. 18, *b*) is similar to the dermal, but mostly somewhat larger and more strongly developed in all its parts. The free ray is generally 190—247 μ long and 30—35 μ broad (together with lateral spines) in the broadest parts. Its rhachis is 7.5—9.5 μ thick at base, and is about as thick or very slightly thicker above in the spiniferous parts. The freely projecting tip of the rhachis is usually of an elongate, conical shape. The lateral spines may reach a length of 30 μ. The basal rays are 30—38 μ long.

The marginalia are the usual rhabdodiactine form of pinules. The distal spiny ray was always found broken off in the outer parts, but seems to greatly exceed in dimensions the corresponding ray of the gastral pinule. The smooth proximal ray is $^1/_3$ mm. or over in length. The thickness of the spicule, close to its 4-tubercled centre, is about 10 μ.

The canalar pinule, present in abundance in the wall of the larger excurrent canals in the proximity of their aperture on the gastral surface, is in part quite similar to the larger gastral pinule, while others differ considerably from these in having much taller pinular ray (textfig. 18, *c*). In fact, I have found that ray in the pinule under question to vary in length

from 220 μ to 470 μ, with an average breadth of about 30 μ in the broadest parts. The basal thickness of rhachis and the length of basal rays are always about the same as in the gastralia.

The hypodermal threads are made up of rhabdoxydiactins and the paratangentials of oxypentactins, the unpaired proximal ray of which serves as the main connection between the dermal and the choanosomal skeleton. In both the kinds of hypodermalia the rays are smooth all over and taper gradually towards the end, which is either sharply or obtusely pointed. The diactins are mostly only 0.5—1 mm. long and not thicker than 18 μ at or close to the centre which may or may not be externally marked by a slight annular swelling. Those which are comparatively short and thick, look like an elongate compass-needle. The pentactins occur not in all, but only in certain, points of intersection of the hypodermal threads. They are rather small, the paratangentials usually measuring not over 275 μ long and 30 μ thick at base and the proximal ray longer. The comparatively sparse occurrence of the pentactins, coupled with the shortness of their paratangentials, seems to stand in relation to the irregular-meshed state of the hypodermal lattice.

A few isolated cases of similar oxypentactins were met with also in hypogastral position; but the hypogastralia are in the main rhabdodiactins which are indistinguishable from those of the choanosome.

The choanosomal supporting spicules seem to consist exclusively of slender rhabdodiactins of varying dimensions, generally under 2.5 mm. length and 25 μ thickness. None of them are sufficiently large to deserve being called tignules. They are mostly quite smooth, and only occasionally tubercled or annulary swollen around the centre. The rays taper usually but little towards the ends which are rounded, otherwise obtusely or sharply pointed. Subterminally they are either smooth or uneven surfaced. Neither ambuncinates nor macrohexactins have been discovered among the choanosomal megascleres.

Microxyhexactins (textfig. 18, *f*, *g*) are present in great abundance in both dermatosome and gastrosome, but much more sparsely in the deeper parts of choanosome. They are very small. Axial length 60—95 μ; rays 2 or 3 μ thick at base, and quite or nearly smooth throughout their length. All the six rays may be straight or nearly straight, but are more frequently gently bent. Sometimes it happens that the rays in one and the same spicule are in part straight and in part more or less distinctly bent.

The macramphidisc (textfig. 18, *d*, *e*) is very plentifully represented in all parts of the body. It is exceedingly variable in size. The majority of it are of a very large size, reaching up to 781 μ in length, while some of the smallest may be half or even only about one-fourth as long. Measurements of a few selected examples as follows:

Entire length	Umbel length	Umbel breadth	Shaft thickness
781 μ	165 μ	220 μ	30 μ.
759 μ	198 μ	242 μ	30 μ
715 μ	165 μ	220 μ	27 μ
600 μ	132 μ	190 μ	27 μ
485 μ	130 μ	154 μ	22 μ
385 μ	90 μ	120 μ	19 μ
319 μ	90 μ	110 μ	—
286 μ	88 μ	120 μ	15 μ
187 μ	75 μ	77 μ	15 μ

The above includes the two extremes of size that were found. The umbel is of a hyperbolic shape in lateral view, consisting of 8 lanceolate and sharply pointed teeth. Its length in the larger examples is somewhere between $^1/_4$ and $^1/_5$ of the length of the whole. In the smaller examples it is generally $^1/_3$—$^1/_4$ the same. It is always broader than long. The axial shaft shows a varying number of small rounded or subconical tubercles scattered on the surface and without forming a whorl around the centre. The tubercles are frequently decidedly sparse in number. Large and small macramphidiscs occur promiscuously in subdermal as well as subgastral regions of the body, apparently without any definite rule as to the manner of their orientation in relation to one another or to the sponge surfaces. On the other hand, it seems that only the larger macramphidiscs, say, of over 500 μ length, occur in the deeper parts of body. They are not at all uncommon, even in the deepest parts of the choanosome. The appearance makes one skeptical if all those large, deeplying macramphidiscs are something that is destined eventually to move up to the sponge surface, for it can scarcely be conceived how an object of their shape and size can shift themselves through the maze of siliceous fibres without serious damages to the parts.

The mesamphidisc might have passed as being entirely absent in the species, had I not come across a few isolated cases of small amphidiscs which may be called by that name. These were only 30 μ long, with semiovoid umbels about $^1/_3$ as long and 11 μ broad. The axial shaft was rough or short-spiny all over.

Micramphidiscs of the usual appearance are common, but not very abundant, in both dermatosome and gastrosome. In the choanosome they are quite rare. Length 20—12 μ; breadth 7.5 μ; umbel of about 15 teeth; axial shaft smooth, generally without, sometimes with, an annular swelling in the middle. Occasionally the micramphidisc is in the form of the paradisc, hitherto known only from *H. alcocki* F. E. Sch. and *H. investigatoris* F. E. Sch. of the Indian Ocean. That peculiar spicule was met with in the present species in both the dermatosome and the gastrosome. In one case measured, it was 14 μ long and 8 μ broad; in another 19 μ long. Its shape agreed exactly with F. E. Schulze's figures of the paradisc of *H. alcocki* (1895, pl. VII, figs. 4*a* and *b*; 1902, pl. VI, figs. 4*a* and *b*).

Remarks. — The above described new species is apparently very nearly related to *H.* (*Paradisconema*) *alcocki* F. E. Sch., but differs from it in the absence of the oscular sieve-plate, in the dermal pinules being much shorter, in the macramphidisc reaching a much larger size and having more deeply bell-like umbels.

The new species seems also to have some very near allies under *Cyliconema*, which subgenus differs in fact but little from *Paradisconema*, except in the absence of the paradisc. *H.* (*Cyliconema*) *ovatum* Ij. (1895) of Japan may probably be regarded as the species under *Cyliconema* which comes nearest to the present species. The resemblance in spiculation between the two is so close that, were it not for the discovery of the paradisc in the latter, they might perhaps have been mistaken for even specifically identical. It may however be pointed out that *H. ovatum* is distinguishable from *H. vosmaeri*, amongst some other points, in the microxy-hexactin being much larger (110—220 μ axial length) and in the smaller size of largest macramphidiscs (up to 550 μ length), the axial shaft of which may be smooth throughout and without tubercles.

9. *Hyalonema* (*Leptonema*) *flagelliferum* n. sp. (Plate II, fig. 14. Textfig. 19).

Stat. 221. 6° 24′ S., 124° 39′ E. 2798 m. 1 specimen.

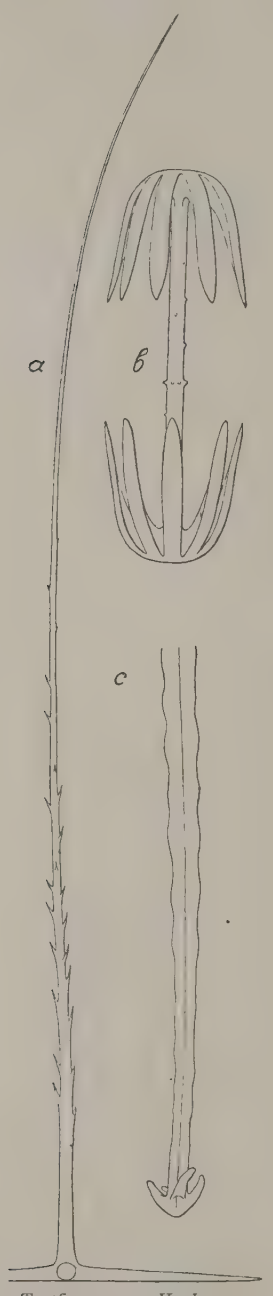
Diagnosis. — Body shape and structure not definitely known. Dermal pinule with relatively long (usually 100 μ) basal rays and with very long whip-like free ray, over 500 μ and up to nearly 800 μ long, filamentously drawn out, sparsely short-spiny and in the distal half of its length almost spineless. Macrohexactins not uncommon among choanosomal rhabdodiactins. Tignule, ambuncinate and microxyhexactin not found. Basal fibres in the inferiormost parts with gentle annular or spiral swellings of surface, instead of being spiny; anchor 4-toothed, the teeth finger-like and all laterally bent in the same direction. Macramphidisc up to 418 μ long, with umbels deeply bell-like, longer than broad, almost $^1/_3$ as long as the entire spicule, composed of 8 lanceolate teeth; axial shaft generally with a whorl of small tubercles around the centre and for the rest either smooth or showing some small tubercles in scattered distribution. Mesamphidisc exceedingly rare, small and not well distinguishable from micramphidisc. Micramphidisc generally 24—20 μ long and about 7 μ broad.

Description. — The type (pl. II, fig. 14) of this new species was obtained at Stat. 221, south-east of Binongka Island in Banda Sea. Unfortunately the sponge body is in a bad state of preservation, having been pressed into a flat and narrow leaf-like sheet 70 mm. long and 13 mm. wide in the middle. Longitudinally right through it runs the columella, which at the basal end of the body emerges as a thin basal tuft. This is over 100 mm. long and only about 1 mm. thick for the greater part of its length. It consists of fibres, fifteen or thereabout in number, and shows the usual twisting nearly throughout the length. This twisted state of the tuft may be looked upon as an indication of the fact that the sponge, in spite of its small size, is in an advanced stage of life. No *Palythoa* invests the root-tuft. The sponge tissues are badly permeated by mud particles, besides containing much Radiolarian and Foraminiferan remains.

What shape and macroscopic structure the sponge should have shown in the original state cannot be exactly ascertained, except that it must have been approximately of the length it now presents, as indicated by the extent of the columella traversing it. However, from the fact that the dermal skeletal layer is recognizably preserved in certain parts of the surface, it may be assumed that in those parts of the specimen the loss of tissues, as the result of mutilation, was not very considerable, and consequently that the sponge, before the mechanical compression took place, was probably not any broader than it is now. If this be true, and if the sponge could be capable of becoming pressed into as thin a sheet as it is, it seems admissible to assume that the original sponge texture was of a loose and much areolated-like nature. Nothing can be said of the condition of the osculum, nor of the gastral area and canals.

Spiculation. — The dermal pinule (textfig. 19,*a*) has a remarkably long, slender and sparsely short-spiny free ray of an exquisitely whip-like appearance. The rhachis, usually found broken off at the distal end, may be over 500 μ and up to nearly 800 μ long; it is about 8 μ thick at base and not more than 3 μ thick at about the middle of its length, being in the more distal parts drawn out into a fine simple filament which is usually more or less bent. The lateral spines, not exceeding 7 μ in length as measured along their inner edge, begin to occur a short distance from the base and are existent in the proximal half of the rhachis, but scarcely or not

at all in the distal half. The basal rays are unusually long, measuring 80—110 μ, and commonly about 100 μ, long. They taper gradually from base to the pointed end, and are nearly smooth or faintly rough on surface. — Gastralia and canalaria could not be distinguished in the specimen.



Textfig. 19. — *Hyalonema* (*Leptonema*) *flagelliferum* n. sp.
a dermal pinule, broken off at the upper end; × 300.
b macramphidisc, × 150.
c inferior end of basal fibre taken from columella, × 50.

All the megascleres of the parenchyma are notably small. Hypodermal oxypentactins with paratangential rays usually under 375 μ length and 12 μ basal thickness; the proximal ray longer. The four paratangentials are quite or nearly in a plane. They form, together with occasional rhabdoxydiactins, the hypodermal threads which, by intersecting, bring about small rectangular meshes of 275 μ or less in the length of sides.

Choanosomal megascleres are mainly smooth rhabdoxydiactins under 1.8 mm. length and 15 μ basal thickness; they usually show a faint indication of an annular swelling around the centre. Tignules were not met with. Nor were ambuncinates discoverable, notwithstanding that I made special searches for them. Not uncommonly there occur, together with the diactins, macroxyhexactins of a size approaching that of hypodermal oxypentactins.

Microxyhexactins have not been discovered. The sponge is probably quite without them.

Acanthophores were found in abundance in and about the columella near its exit from the sponge body. They are mostly stauractins with rays measuring up to 240 μ length and 27 μ basal thickness. The rays are frequently bent. They are tuberculated in the free terminal parts only.

The basal fibres are of various strengths. The strongest was 300 μ thick in the thickest parts, where the surface showed a series of transverse and obsoletely denticulated ridges at intervals of 80—100 μ. A single case of a small basalia, not much over 10 mm. in length, was discovered in the columella (textfig. 19, *c*). It is of a peculiar character, such as is known from no other *Hyalonema*. The anchor is fourtoothed, each tooth being finger-like, rounded at tip and bent near the free end to one side, all in the same direction in a spiral-like way. The breadth from end to end of two opposite teeth is 165 μ. The shaft is 55 μ thick close to its origin from the anchor, reaches greatest thickness of about 100 μ in the inferior half of the entire spicule, and is about 80 μ thick in the middle of same, thence gradually tapering to the uppermost extremity. The shaft, instead of being spiny as usual, shows in the inferior half of its length annular, or perhaps closely spirally winding, gentle swellings of the surface, so that the shaft appears wavily contoured on the sides. In the thickest parts of the shaft, where the swellings are most distinct, there is, in addition an irregular occurrence of some small tubercles on and along the flatly rounded crest; without doubt representing the denticles or spines, usually seen on the basal fibre. But the tubercles here are of a very

limited number and all so insignificant in development that the shaft is far from acquiring thereby a spiny appearance.

Several macramphidiscs (textfig. 19, *b*) were discovered in the choanosome. Five examples measured of them gave following dimensions:

Entire length	Umbel length	Umbel breadth
418 μ	132 μ	115 μ
407 μ	137 μ	120 μ
395 μ	143 μ	132 μ
363 μ	110 μ	100 μ
220 μ	70 μ	70 μ

The macramphidisc is characterized by being comparatively narrow. The umbels are of a deeply bell-like shape, being usually distinctly longer than broad, and are in length approximately one-third that of the entire spicule. The teeth, eight in number to each umbel in the few cases in which the counting could be done, are of a lanceolate shape. The axial shaft is 16 μ thick in the larger spicules. It usually shows a whorl of small tubercles around the centre, the rest of the surface being either smooth or very sparsely and inconspicuously tubercled. The central whorl of tubercles may sometimes be absent.

As the mesamphidisc may be regarded the small amphidisc which was met with exceedingly rarely. Elongate ovoidal in shape, the length measured 27 μ and the breadth 8 μ. The umbel was longer than $^1/_3$ the spicule length; the axial shaft was plain-looking. Perhaps we have here to do with largest examples of the series of the micramphidisc.

The micramphidisc is fairly common in some places, f. i., in the dermatosome. It measures mostly 24—20 μ in length and about 7 μ in breadth. It is therefore relatively broad. The umbel is about $^1/_3$ as long as the length of the whole spicule; the axial shaft is rough and without the central swelling.

Remarks. — The long whip-like dermalia with relatively prolonged basal rays, the macramphidisc with deeply bell-like and relatively narrow umbels of approximately $^1/_3$ the length of the whole spicule, the non-spiny character of the inferior parts of basal needles, and the absence of ambuncinates and apparently also of microxyhexactins seem to constitute the chief diagnostic characters of the species. No known *Hyalonema* species is characterized in the same way.

Among the *Hyalonema* species I have referred to the subgenus *Leptonema* v. Ldfld. (p. 52), *H. campanula* v. Ldfld., *H. divergens* F. E. Sch. and *H. urna* F. E. Sch. have the dermal pinule about as long and slender as the new species described above. *H. urna* has moreover the macramphidisc most approaching that of the present species in appearance, but seems to differ from this in several other important respects.

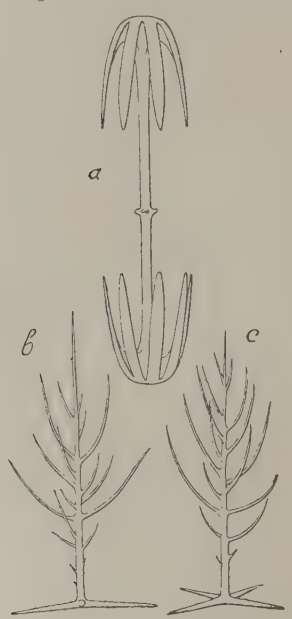
10. *Hyalonema* (*Thamnonema*) *thamnophorum* n. sp. (Plate II, fig. 17. Textfig. 20).

Stat. 221. 6° 24′ S., 124° 39′ E. 2798 m. 2 specimens.

Diagnosis. — Body of a clavate or spindle-like shape, small. Dermal pinule tree-like, with tapering, slender rhachis 125—145 μ long and bearing slender twig-like lateral spines frequently 40 μ or over in length, which give to the entire ray an ovate shape, 50 μ or thereabout in breadth in the broadest part. Hypodermal oxypentactins with paratangential rays

making an angle of slightly less than 90° with the proximal ray. Choanosomal megascleres without tignule among rhabdoxydiactins; macroxyhexactin present. Microxyhexactin 80—190 μ in axial length, with straight and obsoletely rough rays. Macramphidisc 200—400 μ long; its deeply bell-like umbel longer than broad, usually about $^1/_3$ as long, and about $^1/_4$ as broad, as the length of the whole spicule; teeth lanceolate; axial shaft smooth but with a whorl of tubercles in the middle. Mesamphidisc none. Micramphidisc of the usual shape and size, sparse.

Description. — The species is based on two small and immature specimens yet without oscular opening. They were obtained at Stat. 221, a spot south-east off Binongka Island in Banda Sea. They are both of a clavate or spindle-like shape, one of them measuring 12 mm. × 4 mm. and the other 10 mm. × 4.5 mm. The former specimen (pl. II, fig. 17) is provided with a basal tuft, about as long as the body and about 1 mm. thick at origin, the tuft consisting of fine needles, approximately a dozen in number and all broken off at the inferior end. The latter specimen has only a short stump of the broken off basal tuft left to it. In both specimens the superior end of body, which is rounded, shows no trace of an osculum or of postical orifices. The entire external surface presents, under the hand-lens, a finely granular appearance, besides obscurely exhibiting in most parts the small-meshed hypodermal lattice. The general appearance of the specimens reminds one of the type of *H.* (*Corynonema*) *weltneri* which was figured by F. E. Schulze in his report on the Indian Ocean Hexactinellida. The absence of osculum and of differentiated gastral area is probably simply due to the very young state of the specimens.



Textfig. 20. — *Hyalonema* (*Thamnonema*) *thamnophorum* n. sp. *a* large macramphidisc. × 150. *b*, *c* two dermal pinules × 300.

The smaller of the two specimens was for the greater part either teased or laid out into sections and served as basis for the following account of the spiculation.

Spiculation. — The dermal pinule (textfig. 20, *b*, *c*), occurring in crowded distribution, is of a peculiar shape, a like of which is known from *H.* (*Phialonema*) *brevancora* v. Ldfld. The free ray is of a gracile tree-like appearance. The rhachis is generally 125—145 μ long, up to 4 μ thick at base, and tapering to the finely pointed apex, which in most cases is found broken off. The lateral spines, which are not very numerous, attain greatest length in the middle parts of the ray, where they appear like long and slender twigs of the rhachis, not unlike the young shoots of a willow-tree. Such an elongated spine is frequently 40 μ, sometimes even 60 μ, long. The longer spines spring out from the rhachis at rather wide angles and then make a gentle curvature in their entire length, so as to take an obliquely outward and distad direction. The entire pinular ray in lateral view may be called more or less ovate in general form. It may be 54 μ broad in the broadest part. The cruciate basal rays are slender, tapering, sharply pointed at end, and obsoletely rough-surfaced. They are 38—48 μ long and approximately 3 μ thick at base. — Gastral and canalar pinules could not be distinguished.

Hypodermal oxypentactins have paratangential rays, generally 240—500 μ (occasionally 700 μ) long and 10—25 μ thick at base. The proximal ray is much longer than paratangentials

of the same spicule. It joins the paratangentials at an angle slightly less than 90°, so that the plane of the latter forms a flat cone, convex on the outer side. The paratangentials of different spicules join together to form a hypodermal lattice with rectangular meshes, mostly 300—400 μ in the length of sides. There seems to exist no rhabdoxydiactins participating in the formation of hypodermal beams.

Choanosomal megascleres consist of rhabdoxydiactins and macroxyhexactins, both present in about equal numerical proportion. The diactins, perfectly smooth in their whole extent, are of very varying dimensions. A large one may be nearly 3 mm. long and 20 μ thick in the middle, but none is of a sufficiently prominent strength to deserve being called a tignule. Ambuncinates do not exist. — The hexactins have straight rays, reaching up to 900 μ in length and 30 μ in thickness at base. Generally they are so oriented in the choanosome that one of the axes takes a radial direction, and seem to constitute elements which give main strength to the skeleton.

Microxyhexactins occur isolatedly in the choanosome, more numerously in the subdermal region. They are relatively large, measuring 80—190 μ in axial length, the rays probably never exceeding 3 μ in basal thickness. Obsoletely rough on surface, the rays are as a rule straight. Exceptionally one or two of them in a spicule may be slightly bent.

Acanthophores were found in numbers close to the point of exit of the basal tuft. They are mostly stauractins and tauactins of various sizes, with comparatively slender rays, not exceeding 20 μ in thickness and with rather weakly developed tuberculation confined to their terminal parts.

The basal fibres are nearly 100 μ thick in the thickest parts. In certain parts of their spiniferous section the spines are set in scattered distribution in much the same way as I have described and figured (textfig. 16, *d*) from *H.* (*Cyliconema*) *timorense*. However, in the single case of the intact inferior end of an adolescent basalia, I have found the spines of the parts arranged as usual in a spiral-like row. The anchor found on that piece of basalia consisted of a mitre-shaped knob with four strong teeth, and again looked much like that of the species just mentioned (textfig. 16, *e*). Its breadth, from tip to tip of two opposite teeth, was 80 μ. The shaft, for a stretch of 330 μ from that anchor, remained spineless and smooth. At the end of that stretch, where it measured 23 μ thick, began the occurrence of the spines.

The macramphidisc (textfig. 20, *a*) is of a somewhat characteristic appearance. It occurs numerously in the choanosome, apparently without a rule as to the manner of orientation in relation to one another or to the surrounding parts. The length varies from 200 μ to 400 μ, but is mostly above 300 μ. The deeply bell-like umbel is distinctly longer than broad. It is made up of elongate-lanceolate teeth, as a rule 8 (sometimes 7) in number. Its length is about equal to $^1/_3$ that of the whole spicule, or is somewhat shorter than that. The breadth is about equal to $^1/_4$ the same, or somewhat broader. The axial shaft may be 9 μ thick near the middle. It is relatively slender and quite smooth, except for the central whorl of rather prominent tubercles, which usually number more than four at a time. Measurements as follows:

Entire length		Umbel length		Umbel breadth	
200 μ	360 μ	71 μ	120 μ	49 μ	90 μ
210 μ	365 μ	70 μ	110 μ	55 μ	100 μ
253 μ	374 μ	88 μ	120 μ	70 μ	100 μ
297 μ	385 μ	88 μ	110 μ	75 μ	90 μ
340 μ	400 μ	115 μ	120 μ	90 μ	93 μ

The mesamphidisc seems not present.

The micramphidisc of 20—15 μ length and of the usual appearance is sparsely found in the dermatosome.

Remarks. — Notwithstanding the quite immature state of the specimens, there can scarcely be a question as to their representing a new species, readily distinguishable by the peculiar tree-like dermal pinules and the narrow macramphidisc with deeply bell-like umbels.

At one time I was inclined to associate this species with *Hyalonema brevancora* v. Ldfld. under the subgenus *Phialonema* v. Ldfld., on account of the great resemblance of dermal pinules in the two species. But, for this union the difference in the appearance of their macramphidisc seemed to me much too great; so that, after all, I have decided to institute the separate subgenus *Thamnonema* for the present species.

It may further be pointed out that, as regards the appearance of both the dermal pinule and the macramphidisc, there exists a resemblance to a certain degree between this species and *H.* (*Prionema*) *fimbriatum* v. Ldfld.

11. *Hyalonema* (*Corynonema*) *rotundum* n. sp. (Plate II, fig. 18. Textfig. 21).

Stat. 210a. 5° 26′ S., 121° 18′ E. 1944 m. 1 specimen.

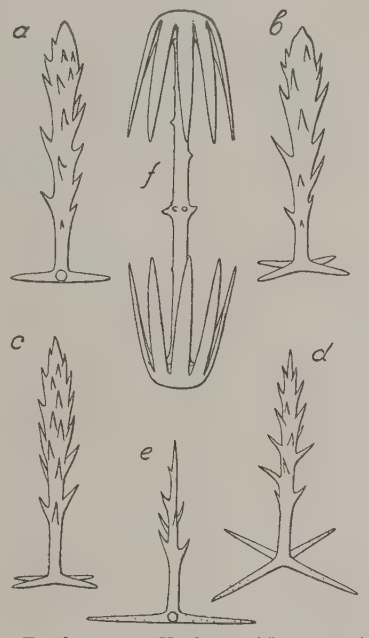
Diagnosis. — Body of an ovoid shape, small. Dermal pinule with rhachis of free ray 100—133 μ long, 6 μ thick at base, thickest (up to 14 μ) above before terminating with conical or mucronate-conical tip, and bearing rather strong, but not very numerous, lateral spines. Hypodermal oxypentactin with paratangential rays in a flatly conical plane, convex on the outside. Choanosomal megascleres of rhabdoxydiactins and macroxyhexactins; without tignule. Microxyhexactin very numerous, 90—140 μ in axial length, with straight and nearly smooth rays. Macramphidisc very sparse, up to 420 μ long, with deeply bell-shaped umbel, about $^1/_3$ as long, and under $^1/_3$ as broad, as the entire spicule length; made up of lanceolate teeth; axial shaft with a few scattered small tubercles besides those in a whorl in the middle. Without mesamphidisc. Micramphidisc sparse, 19—12 μ long and 7.5 μ broad.

Description. — The type of this new species is a small specimen which was trawled up at Stat. 210a, at the entrance to the Gulf of Boni in Celebes. The body is ovoid or nearly globular, 10 mm. long and 8 mm. broad (pl. II, fig. 18). At the upper pole is visible a small osculum, less than 1 mm. across, while the opposite pole gives rise to a slender basal tuft, about 1.5 mm. thick at origin and which in the original uninjured state must have measured not less than 41 mm. in length. The tuft is not twisted and consists of about a dozen fibres all broken off at the inferior end. The dermal surface is in part granular-like and in part shows an indistinct indication of the small-meshed hypodermal lattice.

Spiculation. — The dermal pinules (textfig. 21, *a*, *b*, *c*), very densely set side by side, are characterized by their small size and by the sparsely spiny and club-like development of the pinular ray. The pinular ray measures 100—133 μ in length. The rhachis is thinnest at base, being about 6 μ thick at that point, and thickens distally to a maximum thickness of 13—14 μ, before it terminates with a simple conical or mucronate-conical tip. It bears lateral spines, of which generally only 4—7 are distinctly visible on either side in profile view. They are strongest

and most prominent in the middle parts of the ray, while those at both ends of the spiniferous parts, but especially the few on the terminal cone, are small and inconspicuous. A well-developed spine may be 15 μ long as measured on the inner side, i. e., along the edge facing the rhachis; it stands out from this, forming an angle of nearly 45° or less. The cruciate basal rays of the pinule are 26—38 μ long, 4—5 μ thick at base, obsoletely microtubercled, and obtusely pointed at the outer end.

In the deep parts of the sponge there occur, not uncommonly at certain places, pinules with much more slender pinular ray of 85—140 μ length (textfig. 21, *d*, *e*). The spiny rhachis in those pinules is either tapering from base to end or but weakly fusiform rather than club-like. Without doubt the pinules in question are the canalaria. The basal rays may be 45 μ i. e., distinctly longer than in the dermalia.



Textfig. 21. — *Hyalonema* (*Corynonema*) *rotundum* n. sp.
a, *b*, *c* three dermal pinules, × 300.
d, *e* two canalar pinules, × 300.
f large macramphidisc, × 150.

Of the megascleres, the hypodermal oxypentactins have entirely smooth paratangential rays, commonly 200—450 μ long and 10—20 μ thick at base; the proximal ray is usually much longer than paratangentials in the same spicule. The cruciate paratangentials lie in a flatly conical plane, convex on the outer side. Hypodermal rhabdodiactins must be extremely rare, if they exist at all. — The principal supporting megascleres of the choanosome are smooth macroxyhexactins and rhabdoxydiactins of various dimensions. Both are present in abundance. The former attain a size in which the rays may be nearly 0.5 mm. long and 23 μ thick at base, and are more generally 300—400 μ long and about 14 μ thick. The hexactins are so disposed that they, in combination with the long proximal rays of hypodermal pentactins, bring about a scaffolding with approximately cubical meshes of 130—240 μ sides, though not in a strictly regular way. The rhabdoxydiactins are arranged in no definite manner. They may reach a length of about 1 mm. and a thickness of 15 μ near the centre, which is usually marked by an annular swelling of surface around it. None of the diactins can be called a tignule. No ambuncinate seems to exist in this species.

Stauractine acanthophores were found in numbers near the exit point of the basal tuft. Rays up to 165 μ long and 15 μ thick; beset with tubercles in the distal parts only.

Microxyhexactins occur in great abundance in all parts of the choanosome. Axial length 90—140 μ, most frequently about 100 μ. The rays are slender, generally not more than 3 μ thick at base, always straight, obsoletely microtubercled or nearly smooth. Exceptionally the same spicule occurred in the pentactine form.

Remarkable is the sponge for the paucity in amphidiscs. Nearly a quarter segment of the body was either teased or laid out into sections and was carefully searched for them, with the result that, of the macramphidisc, only three cases were discovered, all imbedded right in the choanosome. Two of them were large and gave the following measurements:

Entire length	Umbel length	Umbel breadth	Shaft thickness
420 μ	130 μ	120 μ	—
363 μ	130 μ	100 μ	12 μ

Both these macramphidiscs (textfig. 21, *f*) are comparatively narrow and have deeply bell-like umbels. They are of approximately the same general appearance and proportions as the corresponding spicule of *H.* (*Thamnonema*) *thamnophorum*, except in the fact that the axial shaft shows a few small and scattered tubercles besides those in a whorl in the middle. The umbel teeth are lanceolate with pointed end. They could not be counted with distinctness, but I believe there were eight of them to each umbel.

The third macramphidisc I have discovered is markedly smaller, measuring 100 μ in entire length, 40 μ in umbel length, and 38 μ in umbel breadth. Each umbel has only 7 teeth, which are rather broad and terminate rounded at the free end. This fact has led me to class the spicule with the macramphidisc, and not with the mesamphidisc, in which the teeth are as a rule narrow and number more than eight in each umbel and which structurally differs but little from the micramphidisc except in relative size.

Mesamphidisc, I have found none in the specimen. — Micramphidiscs were found in sparse distribution. They measured 19—12 μ long by 7.5 μ broad, the umbels being about $^1/_3$ the length of the entire spicule or slightly longer than that.

Remarks. — It is difficult to point out which *Hyalonema* species is most nearly related to the present species. In the club-like development of the rhachis of dermal pinules it is much like *H.* (*Corynonema*) *owstoni* Ij., *H.* (*C.*) *clathratum* Ij. and *H.* (*C.*) *calix* F. E. Sch., but distinctly differs from each of these in many ways. In dimensional proportions of the macramphidisc it somewhat approaches *H.* (*C.*) *depressum* F. E. Sch. and *H.* (*C.*) *cupressiferum* F. E. Sch., but is again very notably different in the appearance of dermal pinules and in some other respects. Under the subgenus *Prionema*, *H.* (*P.*) *validum* F. E. Sch. may be said to come nearest to the present species, but may at once be distinguished from it by the serrated teeth of the macramphidisc, omitting reference to certain other manifest points of difference between the two species. Both *H.* (*Onconema*) *obtusum* v. Ldfld. and *H.* (*O.*) *agassizi* v. Ldfld., though subgenerically distinguishable from the present species by the presence of the so-called "uncinate amphiox", also exhibit more or less resemblance to it in spiculation.

Indeterminable Hyalonematids.

The following stations have yielded specimens which are certainly Hyalonematids and not improbably *Hyalonema* species, but, owing to their being too incomplete, cannot be determined in a more exact way.

Stat. 52 (between Flores and Sumba, 959 m.). A single fragment of a needle, nearly 0.5 mm. thick; evidently from a twisted root-tuft of large dimensions. It may be mentioned that it was obtained together with a small specimen of *Hyalonema* (*Cyliconema*) *apertum maehrenthali* (p. 78).

Stat. 211 (entrance to Gulf of Boni, Celebes; 1158 m.). Some fragments of variously thick needles. The largest piece is 220 mm. long and remarkably strong, being 3 mm. thick in

the thickest parts. It is faintly opalescent, like the needles of the large root-tuft, mentioned below, from Stat. 221.

Stat. 254 (Kei Islands, 310 m.). A piece of a basal fibre, 375 μ thick. It must have originated from the twisted root-tuft of a large individual. The same haul of the trawl has brought up *Hyalonema* (*Euhyalonema*) *keianum* n. sp., *H.* (*Pteronema*) *topsenti* n. sp. and *H.* (*Cyliconema*) *apertum maehrenthali* F. E. Sch., so that the basal fibre in question may possibly have belonged to any of these forms.

Stat. 295 (South of the western end of Timor, 2050 m.). A dead root-tuft of a moderately large *Hyalonema* sp.

Stat. 221 (South-east of Binongka Island, Banda Sea; 2798 m.). A beautiful root-tuft of a great length, freed of all sponge tissues and composed of remarkably strong, up to 2 mm. thick, faintly opalescent fibres. Length of the tuft 1080 mm.; its thickness in the upper parts 7 mm.; number of fibres in the same parts about 20. The tuft is for the great part of its length spirally twisted, the constituent fibres running as usual obliquely from the left above to the right below, as seen on the tuft placed vertically in front of the observer. Most of the longer fibres are thickest in the upper one-third of their length, from which parts they taper more gradually towards the inferior, than towards the superior, end. All the fibres are smooth-surfaced, nowhere showing spines or denticulated ridges. They are invariably broken off at the lower end. In the upper parts of the tuft are found some slender strands, only about 250 μ thick and 200 mm. or more in length, intermingled with others of a much coarser calibre which may be as long as the tuft itself.

Suborder II. **HEXASTEROPHORA** F. E. Schulze, 1899.

Hexactinellids with hexaster, but without amphidisc. (F. E. Schulze, 1904, p. 172).

In contrast to the suborder Amphidiscophora (p. 4), the habitus of body, the canal system and the spiculation are here very much more diverse. The sponge is commonly firmly fixed at its base to the hard substratum, less frequently rooted by means of anchoring needles, and rarely probably inserted in the loose bottom with the basal body parts [1]). In the lophophytous forms the anchoring needles are mostly either pentactins [2]) or anisodiactins [3]), and are but seldom monactins [4]) instead of being always of that holactin kind as in the Amphidiscophora. The spicules of the entire body may be free and not soldered together, either all and without exception [5]) or, except in a small portion, directly adjoining the basal attachment to the substratum [6]); in other cases, the megascleres, which serve as the main support of the choanosome, form a

1) As, f. i. *Trichasterina borealis* F. E. Sch., *Schaudinnia arctica* F. E. Sch.

2) As in *Mellonympha* and *Lophocalyx* among the *Lanuginellinae*, and many Antarctic *Rosellinae*, such as *Rossella antarctica*, *Aulorossella*, *Gymnorossella*, *Anoxycalyx*, *Scolymastra*.

3) As in *Euplectella*, *Holascus*, *Placopegma solutum*.

4) As in *Malacosaccus coatsi*, *Acoelocalyx brucei*, *Docosaccus ancoratus*, *Holascella*.

5) As in most, but not all, lophophytous forms of the Lyssacinosa.

6) The basidictyonal mass found in probably all basiphytous Hexactinellids.

rigidly connected skeleton, either extending throughout the body [1]) or limited to a varying extent of the inferior parts [2]). The superficial covering spicules (dermalia and gastralia) vary from hexactine to diactine or even monactine. They may have the outwardly directed ray pinularly developed, and are then as a rule hexactins [3]). Only exceptionally the proximal ray in those pinules is reduced to a knob or a peg-like rudiment [4]), thus converting them quite or nearly into pentactine pinules like those of all the Amphidiscophora. Intermedial microholactin (microhexactin) is of an occasional occurrence [5]).

As regards the subdivision of the Hexasterophora, I have set forth in a former paper (IJIMA, 1903, p. 25, footnote) a scheme in which it was assumed to consist of three tribes, then provisionally called A, B and C. Of these, A can be held up in unaltered scope and calls for a definitive denomination, while B and C I now find untenable in the sense I have given them, but very appropriately replaceable by the two tribes proposed by SCHRAMMEN under the names of Lychniscosa (1903) and Hexactinosa (1910—12). So then, I now distinguish under the Hexasterophora the three tribes: 1) Hexactinosa Schram., 2) Lychniscosa Schram. and 3) Lyssacinosa n. n.

The tribes Hexactinosa and Lychniscosa, taken together, correspond to the old, well-known group of ZITTEL (1877), the Dictyonia. This name I shall have frequent occasions to use in my statements, but, let it be understood, not as that of a systematic group indicating the common origin of the two tribes, but merely as a convenient term for referring to them collectively. The tribe Lyssacinosa corresponds to the same author's Lyssacina but in exclusion of the Amphidiscophora (F. E. SCH., 1886, 1887), which I have made, in followance of the step taken by F. E. SCHULZE (1889 *a*, p. 93), a suborder equivalent in systematic status to the Hexasterophora.

F. E. SCHULZE (1886, 1887) had originally stood by ZITTEL's way of primarily dividing the entire Hexactinellida into the Dictyonina and the Lyssacina. Later he came to see the untenableness of that position (1899 *a*, pp. 91, 92; 1904, pp. 169, 170) and substituted the division into the Amphidiscophora and the Hexasterophora, giving up altogether the use of the names Dictyonina and Lyssacina as those of phylogenetically separate branches of the Hexactinellida. His ground for holding the distinction between the Dictyonina and the Lyssacina — or in fact, that between the Dictyonina and the group I have called the Lyssacinosa, since the Amphidiscophora have no concern in the question — as inadequate and impracticable, lies essentially in the fact, that the firmly continuous state of the skeletal frame-work is not a peculiarity confined to the former, but is frequently seen in the latter also, on which account it was even said (1904, p. 169), that one often experienced difficulty in deciding whether a sponge belonged to one group or to the other. In referring to the Lyssacina as having a firmly continuous skeletal framework agreeing with that of the Dictyonina, F. E. SCHULZE of course had in mind those Lyssacinosa in which the skeleton is known to become rigid, either in its entire extent or to a considerable extent in the lower parts of body, owing to ankylosis of its constituent megascleres

1) As in the Hexactinosa and the Lychniscosa as well as in *Euplectella aspergillum* and *Corbitella speciosa*.

2) As in certain Euplectellids and Caulophacids, f. i., *Euplectella imperialis*, *Regadrella*, *Caulophacus*, *Sympagella*, etc.

3) As are the dermalia of many Hexactinosa (f. i., *Conorete*, *Bathyxiphus*, *Ptychodesia*, *Tretodictyum pumicosum*, *Sclerothamnopsis*, *Aphrocallistes*, *Heterochone*) and of most Euplectellids and Caulophacids. In *Aphrocallistes* the dermalia may be in part pentactine, but then the atrophied ray is not the proximal ray as in the Amphidiscophora, but the pinular distal ray.

4) As, f. i., in *Caulophacus valdiviae*, *Sympagella nux*.

5) Microhexactin known from the Corbitellinae and also from many species of the Hexactinosa and the Lychniscosa.

at a relatively late period of the sponge's life. But what weighed most with him was his discovery, in the bud-young of the lyssacine species *Rhabdocalyptus mirabilis*, of a reticular skeletal structure (F. E. Sch., 1899 *a*, pl. XIV, figs. 2—6) which was regarded by him to represent the typical dictyonal skeleton and to constitute the actual supporting skeleton of those young individuals; though the same, it was said, does not persist but becomes entirely replaced, at a later period of life, by another skeleton of a genuinely lyssacine nature. With regard to that skeletal reticulum in the bud-young of *R. mirabilis*, F. E. Schulze (l. c., p. 92) has remarked, that it may possibly be only a secondary adaptational arrangement which is useful to them while attached to, and shifting on along, the prostalia of the mother individual, but is of no more use in the grown-up state. It was then suggested by the same author, that many true dictyonine forms might phylogenetically have arisen from the lyssacine in a like adaptational way as the bud-young of *R. mirabilis* with its dictyonine skeleton. It may be noted that he viewed the Dictyonina, in common with O. Schmidt (1880, p. 41), not as a monophyletic group, but as an assemblage of forms which are in relation with the Lyssacina at more than one point, that is to say, if I understand him rightly, should have phylogenetically arisen as several off-shoots from the stem of the Lyssacinosa. While I completely concur with F. E. Schulze in viewing the Dictyonina as probably not a monophyletic group, I must say I cannot share his opinion as regards the relation between that group and the Lyssacinosa.

The most fundamental point in the characterization of the connected skeleton of the Dictyonina is, in my opinion, the fact that the constituent megascleres are as a rule hexactins, in exclusion of any holactin forms with less than six rays. It was quite correctly given by Zittel that the Dictyonina skeleton consists of amalgamated sexradiates. Occasional occurrence of dictyonal spicular elements at a superficial position of the skeleton and showing one or two rays less than the full number, does not interfere with the general applicability of the above rule, since the lost ray or rays in such cases are invariably those which, if present, would have freely projected outwards without being bound to others by ankylosis, and the loss can be interpreted as a secondary happening, after the fusion of the spicule originally as a full-rayed holactin, *i. e.*, as a hexactin. It is safe to say that stauractins, triactins, diactins and monactins never occur among the spicules soldered together. The manner of arrangement of dictyonal hexactins in relation to one another, laid emphasis on by Zittel in his time, is, as was pointed out by F. E. Schulze and as we now know well, of no essential importance as a differential feature of the Dictyonina skeleton in general. Now, since the hexactin can be regarded as the ground-form from which all other holactin forms with less than six rays (with the possible exception of the archaic stauractin and the uncinate (*vide* footnote on p. 6)) were derived, the Dictyonina skeleton, made up, as it practically is, of hexactins only, should be looked upon as one of a very primitive character. The dictyonal skeleton must have come into existence as such at a very remote period of the Hexasterophoran phylogeny, in those ancestral forms which should have had only hexactins as the main supporting spicules of the entire body, whatever might have been the differentiation among spicules of other specific functions. The connected skeletal framework, once established by fusion of the hexactins, there could have been no or but little possibility for the component elements to have undergone reduction in the number of their rigidly fixed rays.

On the other hand, the Lyssacinosa have the supporting megascleres of the choanosome, irrespective of these forming a rigid framework or not, in the form of holactins which, either all or in part, have the rays more less reduced in number from the original six. Hexactins may occur amongst them, but are never the only form of holactins that go to support the choanosome, as they are in the Dictyonina. The derivative holactine megascleres vary from pentactine to monactine, but the most constantly occurring is the rhabdodiactin, which is known from among the choanosomal megascleres of all the Lyssacinosa without exception. In the highly specialized forms (Acanthascinae) of the tribe the choanosomal megascleres are even exclusively rhabdodiactins. The rigid skeletal framework found in fully grown individuals of certain Lyssacinosa, inasmuch as the fusion of the originally unconnected megascleres occurs at a relatively late period of individual life, deviates in no way from the above as regards the holactin kinds that enter into its composition.

The difference, above indicated, between the Dictyonina skeleton and the similarly rigid framework of certain grown-up Lyssacinosa was singularly not taken full account of by F. E. Schulze. The difference is of great importance as showing the independent genesis of each. As I have long since enunciated (1903, p. 24, footnote), the soldering together of spicules in the Lyssacinosa could have set in phylogenetically relatively late and only after a long period of their unconnected existence during which they, in part if not all, should have been able to undergo reduction in the number of rays from the original six; whereas in the Dictyonina all the spicules involved, became fixed in the original hexactine state, owing to the very early setting in, phylogenetically as well as ontogenetically, of the soldering process. It then seems clear that the two kinds of rigid skeleton, occurring in the Dictyonina and the Lyssacinosa, should not be thrown together. I may add that, despite F. E. Schulze's allegation to the contrary, there can never be a difficulty in distinguishing whether a piece of skeleton belongs to a Dictyonina or a Lyssacinosa, unless it be too fragmentary or of an otherwise defective preservation: the observation whether it consists solely of hexactins or includes derivative holactins with a less number of rays, but especially rhabdodiactins, should suffice to make the determination.

In the literature, *Hertwigia* and *Euryplegma* stand repeatedly referred to as sponges which, in the condition of their skeletal framework, combine the characters of both Dictyonina and Lyssacinosa (O. Schm. 1880, p. 41; F. E. Sch. 1887, p. 490; F. E. Sch. 1899 *a*, p. 91). But it must not be overlooked that *Hertwigia*, as we know from F. E. Schulze (1899 *a*, p. 22), has the megascleres, which by fusion form the rigidly connected portion of its skeleton, in the forms of all holactin varieties from the hexactin to the rhabdodiactin, while *Euryplegma* has the skeleton made up of hexactins and apparently hexactins only (F. E. Sch. 1887, p. 177). The antithesis indicated appears sufficient to determine whether either of the genera belongs to the Dictyonina or the Lyssacinosa.

As regards the peculiar skeletal reticulum discovered by F. E. Schulze in the bud-young of *Rhabdocalyptus mirabilis*, I believe it to be a structure identical with that of quite a similar appearance and manner of occurrence, which I have described from a specimen of *Staurocalyptus glaber* (Ij. 1901, p. 186, footnote; 1904, p. 210, pl. XV, fig. 13). The structure in question I hold to be nothing else than the skeletal structure which I have called the basidictyonalia and which I have found to be of a very general occurrence in basiphytous Lyssacinosa in the extreme

inferior parts of the body, directly adjoining the surface of contact with the substratum (Ij. 1901, 1903, 1904). Exactly the same structure seems to exist also in the corresponding body parts of all Dictyonina. Most readily distinguishable is it in the Lychniscosa, in which its component elements are so markedly distinct from those (lychniscs) of the skeleton proper of the main body. Thus, in *Aulocystis grayi*, F. E. Schulze (1900*d*, pp. 313, 314) has observed and correctly described it as a close-meshed skeletal reticulum with "imperforate" nodes, which directly overlies the thin reticulate siliceous layer of the contact surface of the sponge base with the substratum, and which superiorly gradually passes over into the normal dictyonal framework made up of lychniscs. Moreover, F. E. Schulze (l. c.) observed in the body of the same species some small "spheres", consisting of a close-meshed spicular reticulum again with "imperforate" nodes. Some of the spheres appeared to be hollow, but with the internal cavity apparently occupied by some connected lychniscs. The spheres may be simply of the nature of hypertrophical products, due perhaps to some pathological cause. At the same time it occurs to me also quite possible that they are little basidictyonal masses, belonging to the bud-young which have fixed themselves on skeletal parts of the mother individual. I am greatly inclined to view in the same light the similar spheres made up of small, simple, fused hexactins and described by Weltner (1882) from several Dictyonina forms.

The simple hexactins of basidictyonalia are apparently one of the oldest kinds of spicules in basiphytous Hexasterophora, ontogenetically as well as phylogenetically. Combined into a rigid reticular mass, they probably give to the sponge base a firm foundation with which to attach itself efficiently to the substratum or to provide for the building up of the sponge body properly thereon. If so, the basidictyonalia may be looked upon as a special adaptional arrangement, as was suggested by F. E. Schulze in the case of young *Rhabdocalyptus mirabilis*, though not in exactly the same sense as I should put to it. That author assumed the structure in question, as found in the bud-young of that species, to be a transient thing which does not exist in grown-up individuals, but only in the early developmental stage when the young is shifting on or is being displaced by some force along the prostal needles which bear it. Whereas, in my opinion, the said structure in the young of *Rhabdocalyptus mirabilis* or *Staurocalyptus glaber* is a thing found probably in all Hexasterophora which are firmly attached by their base to the hard substratum, and that in the whole period of their attached life. The young individuals referred to have apparently attached themselves on the spicules of the mother individual, and so have developed the basidictyonalia, just the same as they would have done, had they happened to fix themselves on a shell or a rock instead. In the absence of any actual observation which indicates the truth of their ability to shift along the spicules they are attached to, I assume the attachment to be as firm and rigid as when fixed on any foreign object. The liberation of the young, if that happens at all, should take place only by a destruction of the maternal body.

With regard to the morphological relation of the basidictyonalia as found in the Lyssacinosa to the dictyonal skeleton of the Dictyonina, I have stated in 1903 (p. 24, footnote) prematurely that the two are of an identical structure, only in the former case limited in occurrence to the extreme basal end of body, but in the latter most extensively developed so as to serve as the support of the entire choanosome. I now think quite differently. The basidictyonalia is a structure probably common to all basiphytous Hexasterophora, both dictyonine and lyssacine,

which has come into development in relation to their identical mode of attachment to the substratum, but without any direct relation to the flagellated chambers. To be held in distinction from it is the complex of megascleres in the main body parts or the choanosome, which is evidently of an origin in direct relation to, and for the support of, the flagellated chambers. That complex of megascleres is of a widely different character in the Dictyonina and the Lyssacina. The dictyonal skeleton it gives rise to in the former, stands in direct continuity with, and may be in no way demarcated from, the basidictyonal reticulum; yet a distinction should be drawn between the two, not only in view of their different physiological significance, but also of their apparently independent origin at different stages of the phylogeny.

Now, the phylogenetic relations, as I conceive them, of the Dictyonina — which name, as given expressly before, I use merely as a convenient collective denomination of the two dictyonine tribes Hexactinosa and Lychniscosa — and of the tribe Lyssacinosa may be expressed as follows: The three tribes appear to represent as many distinct branches from a common ancestral form of the Hexasterophora, the Protohexasterophora. The Protohexasterophora [1]) must have been lyssacine Hexasterophora, most probably basiphytous and therefore provided with the basidictyonalia, but with the choanosomal megascleres freely and loosely arranged, and all in the fundamental holactin form of the hexactin, in exclusion of such other holactins as have less than six rays. The said megascleric hexactins were probably so arranged in relation to one another, but without being soldered together, as to form a three-dimensional latticework with rectangular or cubic meshes. In this relation the lyssacine species *Leucopsacas orthodocus* Ij. (1903 p. 34) may be regarded, of all the living Hexasterophora known, as the one which seems to have most preserved the primitive arrangement of choanosomal megascleric hexactins. The superficial covering layer of the skeleton may have consisted of either hexactins or pentactins, the latter with the unpaired ray directed inwards. What the intermedial scleres were, cannot be exactly told, except the fact that they comprised, if not consisted solely of, the hexaster and the uncinate, the latter as an inheritance from the oldest Hexactinellidan prototype (cfr. p. 5).

Along with the differentiation of the Protohexasterophora into the three aforementioned tribes, the choanosomal megascleric hexactins in each of the dictyonine tribes (Hexactinosa and Lychniscosa) have become connected together by a soldering process and so have established themselves as the genuine dictyonal skeleton, and that independently in the two tribes. Before that soldering process had set in, the megascleric hexactins of the primitive incipient Lychniscosa (Protolychniscosa) appear to have acquired the character of the lychnisc, *i. e.*, the hexactin characterized by the development of the twelve interactine synapticulae or buttresses around the central node; whereas, in the Hexactinosa the corresponding hexactins have remained in their original simple state. Because of their having become soldered together as hexactins in both the tribes, the spicules have ever since retained their hexactine form. In the tribe

1) The other great ancestral phylum of the Hexactinellida, the Protoamphidiscophora, may be conceived to have been lophophytous lyssacine forms with either hexactins or pentactins, or both, as principal supporting spicules of the choanosome; with pentactine pinules as superficial covering spicules, and with the uncinate and the amphidisc (or the hexadisc), but not the hexaster, among the intermedial spicules. In fact, the spiculation was presumably very much more like that of the Pheronematidae than of the Hyalonematidae or the Monorhaphididae of the present world Amphidiscophora. The Hyalonematidae form a parallel of the Lyssacinosa of the Hexasterophora in that in both the choanosomal megascleres have in part or all undergone conversion into rhabdodiactins.

Lyssacinosa alone, the free state of choanosomal megascleres has persisted, during which period of their unconnected existence it was possible for them in part to change into holactin forms other than the hexactin, but especially into the rhabdodiactin which is constantly and characteristically present in the Lyssacinosa, as in the Hyalonematidae among the Amphidiscophora. In certain forms of that tribe the complex of choanosomal megascleres may undergo fusion and so give rise to a rigid framework, but this should be held in distinction from the true dictyonal skeleton in view of its independent origin, phylogenetically, after the reduction in the number of rays in some of the megascleres had taken place. The hexaster of the Protohexasterophora has passed over into, and is preserved in, all the three tribes; but the uncinate seems to have been inherited by the Hexactinosa only. At any rate, the uncinate is known to exist in a large part of the Hexactinosa, but not in all the rest of the Hexasterophora. It seems that that very old spicule, dating back in its occurrence to the Protohexactinellidan period, has had the same fate in the Hexasterophora and the Amphidiscophora in that it has secondarily disappeared in a part of both.

It will be seen that, while at one with F. E. Schulze in not considering Zittel's Dictyonina as a monophyletic natural group, I differ from him, as before indicated, in regarding it as comprising two separate branches or tribes which are to be derived, not from the Lyssacinosa, but, together with this tribe, from a common prototype (the Protohexasterophora) differing from any of the tribes in certain important respects of characterization. Exactly how the three Hexasterophoran tribes were related to one another at their origin is difficult to ascertain.

Schrammen (1910—12), at the same time that he made a distinction between his Hexactinosa and Lychniscosa as two tribes of the Hexasterophora, has expressed an idea which may be said to be a retrogression from F. E. Schulze's practically tantamount to holding up Zittel's Dictyonina as a systematic group. Schrammen (l. c., p. 189) has remarked that those two tribes might be united into a higher systematic unit to be placed by the side of another unit which should comprise all the lyssacine Hexasterophora (Euplectellidae, Caulophacidae, Leucopsacadidae and Rossellidae). It is therefore clear that Schrammen is for dividing the Hexasterophora primarily into two groups, provisionally distinguished by him with the qualifying terms "dictyonine" and "lyssacine". It is as easy to realize that the former, if regarded as a systematic group, exactly corresponds in scope to Zittel's Dictyonina and should legitimately be called by that name, as to see that the latter is precisely equivalent to my Lyssacinosa. It is immaterial if the two groups be called tribes or not.

The union of the Hexactinosa and the Lychniscosa into a group of a higher grade, but subsidiary to the Hexasterophora, might be regarded justifiable, in my opinion, only if it could be shown that the octahedral buttress formation around the centre of choanosomal megascleric hexactins (lychnisc) in the latter, is a later acquisition than the fusing together of the simple hexactins of the Protohexasterophora into the dictyonal skeleton, — in other words, that the lychniscine dictyonal skeleton arose by complication from the ordinary dictyonal skeleton made up of simple hexactins. If that be so, the Lychniscosa might phylogenetically be regarded to represent a side branch from the Hexactinosa. But, this is not borne out by the ontogenetic fact that the hexactins of the lychniscine skeleton are already developed into lychniscs before

their fusion takes place.[1]) The nodal buttresses without doubt add efficiency to the individual hexactins as organs of support and protection to immediately adjacent flagellated chambers. They may well have developed to the hexactins while these existed, phylogenetically, in the free state; and the lychniscs thus produced may have later dictyonally coalesced as the need arose to give a greater firmness to the entire skeleton. On the other hand, it may be doubted that a dictyonal skeleton, made up of simple hexactins, after having once established itself as such, has had the buttresses supplementarily added to it; since the buttresses, much as they may serve to reinforce the strength of individual hexactins in the free state, do not seem to contribute very effectively to the firmness of the skeleton as a whole. There is, then, it appears, all indication that the two kinds of dictyonal skeleton are of independent origin, which means the separate descent of the Lychniscosa and the Hexactinosa from the lyssacine Protohexasterophora. The possibility of the origin of the Hexactinosa from the Lychniscosa by atrophy of the nodal buttresses may be dismissed as being altogether improbable.

Schrammen (l. c.) has diagnosed the Hexactinosa and the Lychniscosa respectively as "Hexasterophora mit Diktyonalhexaktinen" and "Hexasterophora mit Lychnisken". These diagnoses had, I think, better be amended with the view of avoiding the misleading use of the terms "Diktyonalhexaktin" and "Lychnisk" in the antithetical sense, the latter itself being fundamentally as much a hexactin as the former.

The old way of subdividing Zittel's Dictyonina into the Uncinataria ("Dictyonina with uncinates") and the Inermia ("Dictyonina without uncinates and scopulae"), first laid down by F. E. Schulze (1886) but later justly given up by that author (1904) as he ceased to recognize the Dictyonina itself as a systematic group under the Hexasterophora, is certainly rejectable as running into apparent artificialness. This is partly by reason of the fact, that the absence of the uncinate and scopule, as that of any other loose spicule, liable to become dislodged and lost, is a matter not always accurately determinable under certain circumstances of the state of preservation of the specimens examined, and partly by reason of the fact that the uncinate, inherited from the Protohexasterophora, apparently came into disappearance from loss, independently at more than one point in the Hexasterophoran phylogeny, which makes the matter of its presence or absence unfit for a criterion in an attempt to subdivide the Hexasterophora, the "Dictyonina" or the Hexastinosa into subsidiary groups.

F. E. Schulze's Uncinataria and Inermia were adopted by Schrammen (1910—12) as two subtribes of his Hexactinosa, as a consequence of his making the Lychniscosa a distinct tribe. The Inermia was made by him to contain the two families Dactylocalycidae and Auloplacidae, which both find no place in my new system of classification. The former I dissolve, distributing its genera into the Euretidae, the Tretodictyidae and the Aulocalycidae; the latter, as represented by the living genus Auloplax, is, I believe, really provided with both the uncinate and the scopule[2]), and is therefore not retainable under the Inermia but referable, to judge

1) Origin of lychniscine dictyonal skeleton by fusion of isolated lychniscs figured by F. E. Schulze (1900*d*, Taf. I, Fig. 8—11) from *Aulocystis grayi polae*. The same observed by me in *A. zitteli sibogae*, for which see under that subspecies in this report.

2) This goes forth from the following circumstance: F. E. Schulze, as he described the genus and species *Auloplax auricularis* (1904), has stated that he discovered in its type specimen both the spicules in question, but was in doubt if these really belonged to the species on account of their rareness. In the same year, Topsent (1904*c*) described his *Hexactinella filholi*, a form which, in my opinion, is generically surely not separable from F. E. Schulze's *Auloplax* and is possibly even specifically identical with *A. auricularis*, and, in that form Topsent has found both the spicules, a fact which goes far towards proving the unfoundedness of the doubt entertained by F. E. Schulze.

from its gross structure, to the Tretodictyidae. So that the Inermia may be said to have after all no real existence under the Hexactinosa, and hence can be entirely dispensed with together with their counter-group, the Uncinataria.

Finally it may be added that the Uncinataria F. E. SCHULZE's were taken up by TOPSENT (1904*b*, p. 42) and made a suborder of the Hexactinellida under the new name Uncinatophora, to stand on a par with the suborders Amphidiscophora (Hyalonematidae) and Hexasterophora (Euplectellidae, Asconematidae). How, then F. E. SCHULZE's Inermia should be disposed of, one is left in the dark. Anyway, the division of the Hexactinellida directly into the three suborders is rejectable, since it unwarrantedly relegates to the back ground the manifest fact that all the hexasterophorous forms are unitable into one great group, for which the name Hexasterophora was originally intended.

Differential Key to the tribes of Hexasterophora.

A. Supporting spicules of choanosome forming skeletal framework (dictyonal skeleton) consisting of rigidly connected hexactins in complete exclusion of rhabdodiactins.	
a^1. Skeletal hexactins simple, never lychniscs	Tribe A. HEXACTINOSA Schram., 1910–12.
b^1. Skeletal hexactins all or commonly lychniscs.	Tribe B. LYCHNISCOSA Schram., 1903.
B. Supporting spicules of choanosome primarily and commonly all free, sometimes in part or all rigidly connected by secondary fusion; consisting of holactins with a varying number of rays but always comprising rhabdodiactins amongst them	Tribe C. LYSSACINOSA, n. tr.

Tribe A. HEXACTINOSA Schrammen, 1910—12.

HEXACTINOSA Schram., 1910—12, p. 187. — HEXACTINOSA partim, Schram., 1903.

Hexasterophora with dictyonine skeletal framework consisting solely of simple hexactins.

SCHRAMMEN's Hexactinosa, in the sense given it by that author in 1910—12 (p. 187; not in the broader sense he gave it in 1903, which made it comprise the Lyssacinosa), may be regarded a natural group, though perhaps not with entire satisfaction. For the present I will abide by distinguishing six living families under the tribe, viz., Farreidae F. E. Sch., Euretidae F. E. Sch., Tretodictyidae F. E. Sch., Aulocalycidae n. fam., Aphrocallistidae J. E. Gray, and Craticularidae Rauff. The family Dactylocalycidae, once instituted by me (1903, p. 25) on grounds which I now recognize to be inadequate, is herewith withdrawn. The genera which were referred to it by me and by F. E. SCHULZE (1904) are now distributed in the following way: *Margaritalla*,

Myliusia and *Dactylocalyx* taken up under the Euretidae; *Auloplax* under the Tretodictyidae (see footnote on p. 112); *Aulocalyx* and *Euryplegma* under the Aulocalycidae.

The six Hexactinosan families, mentioned above, can be arranged, in my opinion, into two groups or subtribes. One of these, consisting of the single family Farreidae, is exactly identical with F. E. Schulze's (1886, 1887) subtribe Clavularia; the other includes all the rest of the families and corresponds to the same author's subtribe Scopularia and, in addition, to his tribe Inermia, but in exclusion of the Lychniscosan genus *Aulocystis*. Thus, the second group is in part known to be in possession of the scopule, while from the rest that spicule is unknown presumably owing, not to its real or ab origine absence, but to either the defective state of the preservation of spicules in the specimens studied, or to the fact that it, or the immediately preceding prototype which gave rise to it, has disappeared during the later phylogeny of the forms concerned. On the basis of that assumption I adopt for the second subtribe the name Scopularia, but giving it a much more extended sense than F. E. Schulze gave it. That author has altogether relinquished the distinction between the Clavularia and the Scopularia, together with that between his families Farreidae and Euretidae in 1904 (p. 177). My grounds for reinstating the distinctions will be adduced further on, in connection with the Hexactinosan spicules I have collectively called the sceptrule.

General habitus. — The Hexactinosa are all basiphytous sponges, firmly attached to some foreign object. From the initial, more or less cup-like shape of the body at the commencement of growth, the later development of body form may be said to take place in five chief ways, as follows: Firstly, the cup may grow into a simple elongate tube with a single osculum at the upper end (as in *Tretorete*). Secondly, the cup, as it enlarges, expands and takes the form of a bowl or a dish; later a complication may set in by the wall becoming lobed and plicated (as in *Hexactinella ventilabrum*). Thirdly, the cup assumes a tubular form, and by repeated dichotomous division during growth, there arises a complex of branch tubes of a similar calibre, which may anastomose but finally terminate each with an osculum of a similar size (as in *Farrea*, *Eurete*). Under circumstances the branches arise as buds or outgrowths, either in the form of caecum-like evaginations of the wall (as in certain forms of *Aphrocallistes beatrix*) or of massive protuberances which, though canalized in a way, lack internally a direct continuation of the gastral cavity (as in *Tretodictyum tubulosum*). Fourthly, the initial cup grows into a calyciform main body with a main osculum at the superior end and bearing on the outside of lateral wall a number of relatively small, simple or branching tubes, ending each with a lateral or accessory osculum (as in *Periphragella elisae*, *Lefroyella decora*). This condition of the body may readily be conceived as a deviation from that produced by the foregoing way, in that the axial gastral passage, extending from base to an osculum at the upper end in the latter, is here much widened over the calibre of the tubes composing other parts of the complex. Sometimes the lateral tubes arise in the form of blind evaginations which may or may not secondarily open in a lateral osculum at their outer end (*Heterochone calyx* [F. E. Sch.], *Aphrocallistes*). At other times, the lateral tubes appear to be entirely suppressed, but to leave their oscula existent as simple fenestra-like apertures in the calyciform wall (as in *Rhabdodictyum delicatum* [O. Sch.] F. E. Sch.). Fifthly, the initial cup, instead of growing uniformly at all

points of its rim, grows only at a section of it; so that, the result is a shoe-horn-like or ear-like (*Hexactinella grimaldi*, *Euryplegma auriculare*), sword-blade-like (*Bathyxiphus*), or broadly plate-like (*Ptychodesia doederleini* [F. E. Sch.]) body shape.

Skeletal meshes and canals. — In the simplest state of the Hexactinosa (or in fact, Dictyonina) skeleton the only spaces contained in it for the passage of the water are dictyonal meshes, e. i., interspicular spaces of quite limited dimensions, which usually do not exceed by much the length of the hexactin rays, concerned in bounding them, but may be considerably shorter than them. That is the state of the dictyonal skeleton which is usually regarded as being non-canalized or without canals, the use of the term "canal" being reserved to those spaces in the skeleton which in length and width by far surpass ordinary dictyonal meshes in the surrounding skeletal reticulum.

Dictyonal skeleton quite or nearly without canals is characteristic of the Farreidae, the Euretidae (with the exception of *Ptychodesia* which exhibits a special kind of canals) and the Aulocalycidae.

A typical and well-known example of non-canalized skeleton is afforded by *Farrea*, a form which may be regarded to be of the most primitive characterization as regards the arrangement of its skeletal parts. At the commencement of its existence the *Farrea* skeleton is, as is well known, a single-layered latticework with plane quadrangular meshes, each and every one of which contains a close group of radially elongate chambers or a chamber-bearing diverticulum of the reticulate choanocytal membrane. The individual hexactins making up the latticework, are so oriented that, with one axis radially disposed in the interspace, surrounded by every four chamber groups, the two paratangential axes run longitudinally and transversely between every two pairs of same, plainly indicating the origin of the hexactins, and also of the entire latticework, in intimate association with the said chamber groups. As the sponge advances in growth, a new layer or layers of a similar latticework are added, within certain limits, to the external side of the one already present, thereby giving rise to three-dimensional (six-faced polyhedral) mesh-spaces, arranged in a continuous row or rows as seen in sections. Each of these spaces, or where they exist in tiers one above another, each radial series of them, constitutes a passage occupied within by a chamber-bearing diverticulum, now more or less tubularly prolonged in the radial direction. The point is excellently shown in F. E. Schulze's *Farrea* plates in the Challenger Report. Each new latticework layer added to the skeleton is, in its relation to the chamber-bearing diverticula, just an exact repetition of the first-formed layer. A change in the above arrangement sets in as the sponge or sponge parts grow old. It consists essentially in irregular additions of later developed skeletal hexactins to dictyonal beams, whereby the primary three-dimensional mesh-spaces become subdivided into those of an irregular shape and smaller dimensions, and in the apparent withdrawal, proximally, of some chambers from certain mesh-spaces which may then serve as free pathways for the fresh sea-water to reach the more deeply situated chambers. Further, anastomosis may at places arise laterally between chamber-bearing diverticula which originally existed as independent outbulgings.

Variations in the condition of dictyonal skeleton from that seen in *Farrea*, are caused chiefly by the different manner in which the skeletal hexactins, forming the fundamental frame-

work, may be arranged in relation to one another and by the appearance of spaces of sufficient dimensions to be called canals. The initiative to those variations can have its seat only in the growing sponge margin where the framework is in the making, and may be assumed to stand directly in relation to the condition or the state of arrangement of the inceptional chambers or outbulgings of the choanocytal membrane in that region of the body.

The canals observed in the skeleton of the Hexactinosa may be distinguished, in view of their morphological and physiological relations, into: *a*) amararhysis, *b*) schizorhysis, *c*) diarhysis, *d*) epirhysis, and *e*) aporhysis.

a) Amararhysis. This is the canal known to me from the Euretid genus *Ptychodesia* Schram. (*P. doederleini*) before referred to. We have here to deal with tunnel-like canals of a varying length which run longitudinally with intervals of an indefinite width between them; are open on the gastral surface by slit-like apertures; and where there exist ledge-like or papilla-like prominences on the dermal side of the wall, send out radial branch canals into these to open accessory oscula on their top. Unlike tubo-branches similarly open at the outer end and formed by the folding or outbulging of the wall, the canals in question manifestly represent gap-like spaces which have arisen within the primary thickness of the wall, as is attested by the fact that the slit-like gastral apertures are found, in the beginning of their existence, spanned over by the gastral membrane which later becomes lost in their area, — a fact which precludes the possibility of the canals having arisen by a folding of the skeletal layer. The longitudinal canals may be said to run along and in direct touch with the gastral surface, but separated from the dermal by some strata of the dictyonal latticework. They are apparently spaces which have developed inside of the chamber layer, and are walled in all their parts by the inner surface of the dictyonal layer, on which should open the inner or excurrent ends of chamberbearing diverticula. The same can be said for the wall surface all around of the radially running portions of the canals. Hence, it may be concluded that the water, finding its way into the canals, is entirely that which has passed through the filtering wall of the chambers. From the canals it can find egress to the exterior by both the gastral slits and the accessory oscula on top of the protuberances of the dermal side. The canal agrees with the aporhysis in being concerned with only the discharge of water, but is in all appearance of an independent origin and morphologically distinguishable from the latter by the different direction of its course in the wall and by its direct connection with the external world through accessory oscula.

b) Schizorhysis. This is a system of peculiar canals which I regard to be characteristic of the Tretodictyidae. It is essentially cleft-like or canal-like gaps extending through the entire thickness of the dictyonal wall and which place the subdermal space in free communication with the gastral cavity. It is never freely open on the dermal surface but is always covered over by the continuous dermal layer; nor does a filtering partition, the reticulate choanocytal membrane, exist anywhere or anywise in its pathway between the subdermal space and the gastral cavity.

When typically developed, as, f. i., in *Hexactinella*, *Anomochone* or *Tretodictyum*, (see relevant figures in pls. XVIII—XX, this report), the schizorhyses, as seen on the sponge surface, appear like numerous canals or grooves, running side by side in varying directions, though on the whole longitudinally with respect to the long axis of the sponge body. They

are seen to divide frequently as well as anastomose with one another in their course. In width they are usually and on the whole about as wide as the intervening septa made up of dictyonal latticework with three-dimensional meshes (pl. XVIII, fig. 6; pl. XIX, figs. 17, 18; pl. XX, fig. 1). Moreover, the septa do not represent simple continuous plates, but exhibit a series of breaks or gaps in their continuity which bring any two adjacent schizorhyses into intercommunication with each other. So that the schizorhyses of the entire body form one continuous system of intercommunicating canalar spaces. Externally these are extensively open, like grooves, provided the covering dermal layer is not preserved. Internally the schizorhytic spaces directly join the gastral cavity, either as several clefts which they themselves are (as, f. i., in *Tretodictyum*) or by means of relatively wide and freely open perforations through a thin hypogastral dictyonal plate which connects the gastral edges of interschizorhytic choanosomal septa (as, f. i., in *Hexactinella*). Under circumstances the direct communication of the schizorhysis with the gastral cavity may be partially intercepted by the occurrence of a gastral layer over its internal openings.

Sometimes the schizorhytic system is developed in a condition which makes it at first sight not easily distinguishable from a labyrinthic system of cavaedial or intercanalar spaces, as, f. i., in *Psilocalyx wilsoni* n. g., n. sp. (pl. XXIII, figs. 1, 2). In such cases, the criterion for determining the schizorhytic character of the spaces will be afforded by the existence of open communications between them and the gastral cavity, taken in conjunction with the absence, in the intervening skeletal parts, of an open lumen leading directly into the latter.

As may readily be observed from the state of the skeleton at the growing margin of the sponges, the schizorhysis develops as the result of the intervening septa undergoing repeated division and anastomosis in alternate succession as the growth proceeds. The division takes place not only in the plane of the sponge wall, but also in other planes varying from it, so that all the interseptal spaces, i. e. the schizorhytic spaces, stand in intercommunication between them at one place or another. Since I take the dictyonal latticework for a thing which develops only in direct and intimate association with the chambers, the suppression of its formation between the septa, seems, at those places, to be due primarily to an early formation of gaps in the continuity of the chamber layer. It may be said that the schizorhysis, considered as a gap extending right through the thickness of the choanosome, comes into existence at the growing sponge margin in much the same way as an accessory or lateral osculum, but with this important difference that, whereas the former remains externally covered over by the dermal layer, the latter forms itself as a clear perforation, passing through the entire thickness of the sponge wall. There is the indication that the schizorhysis is for leading the water into the sponge body, and not for its exit from the gastral cavity as the oscula are.

The arrangement of the chambers in the septa requires yet to be exactly studied. But, even now, to judge from the manner of their situation in relation to septal parts, they can be distinguished into: firstly, those which, being most peripherally situated in the choanosome, receive the water directly from the external world and discharge it into the schizorhysis; secondly, those which receive it from, as well as discharge it into, the schizorhysis; and thirdly, those most deeply situated, which receive it from the schizorhysis and discharge it directly into the gastral cavity. It then seems to stand out clearly that the schizorhysis serves as the way out for the water which has passed through the peripherally situated chambers with apopyles opening

into it, and at the same time facilitates the access of fresh (unfiltered by the reticulate chamber wall) or relatively fresh sea-water to the more deeply situated chambers, thereby counterbalancing the unfavourable condition of those chambers with respect to the supply of such water, accruing from an increase in thickness of the sponge wall.

As will have been noticed, the schizorhysis of Tretodictyids constitutes quite a special kind of the sponge canal-system, the exact relations of which seem to have hitherto remained unrecognized in the true light.

c) Diarhysis. By this name I call the well-known radial canals in the honeycomb-like skeleton of the Aphrocallistidae. Those canals, when typically developed as in *Aphrocallistes* and in the intact state of specimens, are covered at the outer end by the dermal layer and at the inner by the gastral layer, and in default of these covering layers, as in all macerated specimens, are quite open at both their ends. All the canal passages are apparently in a state of utmost widening and mutual pressure, the result being their hexagonal shape in cross-section and the compression of intervening skeletal septa into flattened reticular plates. This compression is of a sort that the constituent hexactins are frequently found with certain of their rays so bent as to lie together with the rest in the same septal plate. The lumen of each and every canal is occupied, as I can say on the basis of original observations, by a group of some radially directed, irregular-shaped, caecum-like chambers, which are arranged in a circle with their outer lateral sides closely opposed to the canal-wall, but leaving in their middle an axial incurrent space, standing in open communication with the external world through the dermal lattice and internally ending in a blind way between the bases of the chambers. This relation of the chambers to the diarhysis has been shown with essential accuracy by F. E. Schulze in his figures for *Aphrocallistes* in the Challenger Report. All the water which enters the diarhysis by its outer aperture has to pass through the reticulate wall of the chambers before it finds egress from its inner aperture into the gastral cavity. In this respect the diarhysis is in essential agreement with the radial series of cubic dictyonal meshspaces in *Farrea*, containing, as it does, a chamber-bearing and tubularly prolonged diverticulum of the choanocytal membrane.

Besides *Aphrocallistes*, there is to my knowledge another form which, in my view, is in possession of essentially the same diarhysis, though much less regularly prismatic in configuration and different in some other points of minor importance. It is *Heterochone*, a new genus which I have separated from F. E. Schulze's *Chonelasma* and has *Heterochone calyx* (= *Chonelasma calyx* F. E. Sch. 1886, 1887) for the genotype, and which I take no heed in ranging under the Aphrocallistidae. The radial canals of *H. calyx* were regarded by the original describer of the species to open alternately on the outer and inner sides of the wall as if they were epirhyses and aporhyses, but their read condition seems to have remained not clear to him. According to my own observations on a series of well-preserved specimens, the canals are all clearly open on the dermal side except for the presence, in the perfect state of preservation, of the dermal layer which continuously covers the entire external surface of the sponge. The inner or gastral canal-ends, unlike the dermal, are not uniformly alike in their condition. They vary from appearing completely or partially covered, to being really freely open to the gastral cavity. In the young state of the sponge wall, as represented in its growing parts, the inner canal-ends are spanned over by the simple gastral layer exactly as are the outer ends by the dermal. The canals in

that state are quite like the diarhysis of *Aphrocallistes* in all important respects. As the growth of the wall advances there is a development, as a supplementary addition to it, of a thin hypogastral dictyonal layer in union with the inner edge of intercanalar septa. This layer is of a cobweb-like irregular structure, exhibiting irregular meshes or gaps of very unequal sizes, and supports the gastral membrane which is perforated by large and small roundish apertures corresponding in situation to those hypogastral gaps. The apertures in the gastral and hypogastral layers do not always correspond, either in size or position, to the inner canal-ends. Now, those of the latter which happen to lie, as they frequently do, in a position just within the larger gastral and hypogastral apertures, naturally appear freely open to the gastral cavity; while others of the inner canal-ends may appear more or less obstructed, as passages into the gastral cavity, by the beams of hypogastral and gastral layers running over or across them. The latter sort of canal-ends differs from the former only in opening into the gastral cavity by a varying number of relatively small apertures instead of by a single large one. The difference is apparently nothing of quality, but simply one of degree. In short, all the radial canals of *Heterochone* can be regarded as being "open", both externally and internally, and as essentially agreeing in this respect with those of *Aphrocallistes*. Should the soft parts of *Heterochone* be worked out, I expect it will most probably be found that the radial canals, each and all alike, contain the chambers in essentially the same arrangement as those of *Aphrocallistes*.

d) Epirhysis and *e*) Aporhysis. These may be distinguished into the intradictyonal and the extradictyonal or cavaedial. The distinction is based on the fact that, while in certain cases the canals can be regarded as being of an origin within the primary thickness of the dictyonal wall, in other cases they are productions outside the basic dictyonal layer which is without canals and contains dictyonal mesh-spaces only.

Intradictyonal appear to be the well-known, concomitantly occurring systems of epirhysis and aporhysis in the Craticularidae. Here the canals of both the systems penetrate the wall radially and are pretty closely set. They are deep and pit-like, their blind end being situated close to, or a short distance below, the wall surface opposite their external aperture (ostium or posticum, as the case may be). Canals of the two systems occur in alternate disposition, running alongside of one another with nearly their entire length or at least with their inner parts. Their external apertures on either wall surface may sometimes be somewhat irregularly distributed, but are more commonly arranged in two intersecting systems of rows, either both obliquely or one transversely and the other longitudinally running.

The canals arise evidently pari passu with the first formation of the dictyonal layer at the growing margin of the sponge. As regards the genetic relation of the canals to the chamber layer, two possible ways can be imagined. Firstly, the canals may have been derived from diarhyses, such as are found in the Aphrocallistidae, by closure of certain of them at the outer end (aporhyses) and of the rest of them at the inner end (epirhyses). In this case all the canals alike should have originally contained each a chamber-bearing diverticulum of the choanocytal layer, but which diverticulum subsequently probably underwent atrophy in the epirhysis, though persisting in the aporhysis, so that this came to receive the fresh sea-water not only directly from the exterior at its blind end but also from the epirhyses on the sides. Secondly, it is also possible that the epirhysis and the aporhysis represent spaces, respectively outside and inside

of the chamber layer, the former developing in the interspace between every four chamber-bearing diverticula or thereabout in number, and the latter being practically identical with the lumen of those diverticula; in which case, the canals shall have to be regarded as ab origine epirhyses and aporhyses, exactly comparable to those of the Lyssacinosa or the Amphidiscophora in their relation to the chamber layer. At the present there exists no reliable clue by which to decide between the two ways indicated as more probably the true one.

It will be noted that a folding or outbulging process, or a growth in thickness, of skeletal parts themselves has nothing to do with the formation of epirhyses and aporhyses of the above type. It is otherwise with those of extradictyonal or cavaedial origin. These are obviously either depressions recognizable as such owing to elevation of surrounding skeletal parts, or portions of grooves formed by longitudinal plication of the dictyonal wall.

Indications of epirhyses or epirhysis-like depressions arising in the former way, are not infrequently met with in the Farreidae and the Euretidae, in those forms which, save for their presence, can be said to be entirely without canals. Hereto belong the little shallow pits or poxmark-like recesses observable on the external skeletal surface of *Farrea lendenfeldi* (pl. XIII, fig. 16), *Periphragella parva* (pl. XIV, fig. 1—3), some *Pararete* species (pl. XVI, figs. 1, 22), *Gymnorete variolosum* [1]), etc. In none of these cases do aporhytic depressions seem to be developed on the gastral side. In *Tretopleura candelabrum*, a new Aulocalycid form described in this report, there exist both epirhyses and aporhyses very conspicuously developed as vertical pits, which admit of being interpreted as depressions, left behind as such coincidently with outward growth of the superficial skeletal parts around and between them, whereby the wall became greatly increased in thickness (pl. XXI, figs. 8—12). Within the thick skeletal wall of that species and somewhat nearer its dermal than gastral surface, there extends, parallel to the surfaces, an intermedial dictyonal stratum, ill-defined in its limits, yet sufficiently distinguishable as a continuous layer by a set of strong beam fibres traversing it longitudinally and by containing no other spaces than dictyonal meshes (pl. XXII, fig. 1). On both its sides that intermedial stratum passes over into thick superficial dictyonal layers of a somewhat different texture, which layers are penetrated by wide epirhyses or aporhyses, as the case may be. The inner or blind ends of these oppositely open canals by no means interlook as epirhyses and aporhyses of intradictyonal origin invariably do, but are interceded by the thickness of the aforesaid intermedial dictyonal stratum. That stratum, unpenetrated by the canals from either side, I regard to represent the original or basic skeletal wall formed at the time of the first development of the parts; and the intercanalar dictyonal parts on both its sides to be secondary outgrowths from it. I presume that the chamber-bearing diverticula of the choanocytal membrane, which originally should have been confined in their radial extension to within the limits of the basic parts, have prolonged themselves distally with their blind end and proximally with their open end, and so have given cause to the secondary addition of skeletal parts to the respective side, but leaving necessary canalar spaces for leading the water into, and out of, the deeper parts of the wall.

Longitudinal plication of the dictyonal wall is known in certain forms of the Euretidae

1) A new Euretid genus and species, yet undescribed, from Sagami Sea. Under the same genus is to be placed the species described by Topsent (1901 *b*) under the name of *Eurete alicei*.

(*Lefroyella*, *Dactylocalyx*) and of the Aulocalycidae (*Aulocalyx serialis*, *Euryplegma auriculare*), among the Hexactinosa. As a result of the folding there arise alternating external and internal grooves which may be called epirhytic and aporhytic respectively. But the grooves are frequently so broadly open that they can hardly be called canals. With respect to *Lefroyella*, this holds good for the external grooves in certain parts of the body (pl. XXI, fig. 3); but in certain other parts of it, notably in the older parts (pl. XXI, figs. 2, 4, 5), the said grooves appear partially filled in by secondarily formed dictyonal tissue, but leaving behind pit-like depressions which can appropriately be called epirhytic canals. On the other hand, the internal grooves give to the gastral surface a fluted appearance, though traversed across, at varying intervals, by connective dictyonal bridges or divided at times into somewhat canal-like compartments by relatively broad partition walls formed by the growing together of their opposite wall surfaces. The internal grooves, besides being open gastrally, are also open on the dermal side by a series of accessory oscula, situated on the externally directed ridge of parietal folds. So that, the internal grooves of *Lefroyella* are after all of very much the same character as the lumen of tubo-branches, open at the outer end, except in their being elongated outbulgings instead of being tubular. In the Aulocalycid *Euryplegma auriculare* there seem to exist distinctly canalar epirhyses and aporphyses developed from parts of external and internal grooves between longitudinal folds of the wall.

Spiculation. — The manner in which the skeletal hexactins are arranged in relation to one another in forming the dictyonal framework, varies to a very considerable degree within the tribe. In view of the rigidly fixed state of the spicules after development of the skeleton, the variation can arise, phylogenetically as well as ontogenetically, only in the growing parts of the sponge where those spicules are being individually developed. As before indicated, the skeletal hexactins can be regarded to originate there in intimate topographical relation to, and specifically for the support of, the newly formed diverticula of the choanocytal membrane. It can therefore be readily thought of that certain variations in the latter may cause variations in the relative orientation of the former, or may even lead to the formation of intradictyonal canalar spaces where these were originally absent. In fact, the variation in the structure of dictyonal framework may be viewed in much the same light as that of a shell dependent upon certain variation of the soft-bodied animal which produces it.

In dealing with structural variations of the skeleton it would be only necessary to regard it in the condition of its first foundation. The deviations from it which later set in by secondary accretion of hexactins in irregular orientation are only of a subsidiary importance. The regularly quadrangular- or cubic-meshed dictyonal latticework, seen in many Hexactinosa, but most extensively developed in the younger parts or developmental stage of *Farrea*, may be regarded to represent the original and basic way of arrangement of skeletal hexactins. The latticework is formed by lateral apposition and coalescence of the rays of adjacent hexactins. All the internodal beams therefore exhibit two axial canals, running side by side through them, while the nodes are each a hexactin centre (true node) whence radiate six of those beams like as many simple rays entirely their own. Only the harrow-tooth-like processes (called by me the spike) projecting freely outwards from superficially situated nodes are simple hexactin rays. From the manner of composition of internodal beams the dimensions of the meshes generally correspond, more or less, to the length of the rays of hexactins bounding them; and since the hexactins are all of

a moderate size, so are the meshes likewise of moderate dimensions which vary but within a limited latitude.

It seems a short step of variation from the above, should there exist, together with rectangular, trapezoidal or somewhat irregularly polygonal dictyonal meshes, some others of a triangular shape. Dictyonal skeleton with such varieties of meshes is in fact by no means uncommon. It will then be observed that not all the internodal beams are amalgamated combinations of two laterally apposed rays belonging to different hexactins, but certain of them are simple and singly running rays which terminate by joining with their end either an adjacent hexactin node or dictyonal beam toward which they are directed; the result being that there now exist some multiradiate true nodes, i. e., hexactin centres whither converge beams in a number more or less in excess of six, and also some false nodes, i. e., those which represent simply points of union of rays from different hexactins but hexactin centres. Especially in *Eurete*, *Pararete* and some other Euretid genera, triangular dictyonal meshes in conjunction with multiradiate nodes are of a very frequent occurrence, giving rise to that kind of beam arrangement which was called "rotulate" by BOWERBANK.

In the Aulocalycidae the manner of arrangement of skeletal hexactins is exceedingly irregular. The meshes may generally be said to be of an indefinite shape, varying in dimensions from being unusually large to being very small. The hexactins have rays frequently prolonged to a great length and curved in their course. Such rays, coming from different hexactins, may intersect one another in various angles and come into fusion at the points of intersection. At places rays are seen to come into lateral apposition and coalescence. Frequently too, there are those which with their end abut on and join others in various angles. Moreover, it is not uncommon that proximately running rays are connected together by synapticular bars, and not seldom by a series of these, which then bring about a singular ladder-like formation. Under the above circumstances it cannot but be that false nodes greatly preponderate over the true in the number of occurrence.

The skeleton of the Aphrocallistidae present another case in which the constituent hexactins have assumed a very irregular way of arrangement and mutual connection. This may be due, at least in a measure, to the development of the diarhysis before described, which by encroaching upon the space of interdiarhytic septa, may have affected the conditions of the development of skeletal hexactins. The fact that skeletal hexactins in *Aphrocallistes* are frequently found with their rays so bent as to lie all in nearly the plane of the septum they compose, is plainly indicative of the unusually constrained condition under which they have originated.

The family Craticularidae exhibits, notwithstanding the presence of epirhytic and aporhytic canal-systems, a dictyonal framework which, in the manner of arrangement of its hexactins, generally does not run beyond the range of variation that we see in the Euretidae.

With respect to the free spicules of the Hexactinosa, I limit myself to making the following observations.

The dermalia are either hexactins, in most cases with the distal radial ray pinularly developed, or pentactins with the unpaired ray proximally directed. It is an enigmatic fact that the ray which in the one case shows a special development, is the one which in the other case is entirely suppressed. The Euretial genus *Heterorete* Dandy and *Gymnorete* (IJ.) and the

Tretodictyid genus *Psilocalyx* n. g. appear to be destitute of a dermal layer, at least in the grown-up state of individuals. The hypodermalia, as also the hypogastralia, are as a rule not differentiated, which negative character the tribe shares with the Lychniscosa and also with the Lyssacinosan families Leucopsacadidae and Euplectellidae.

The gastralia are as a rule similar spicules as the dermalia of the same species. Exceptions to the rule are *Bathyxiphus subtilis* and *Aphrocallistes* in which they are pentactins or rhabdodiactins respectively, the dermalia in both being generally pinular hexactins. In some forms the gastralia seem to be not definitely differentiated.

Apart from the rhabdodiactine gastralia above mentioned of *Aphrocallistes* and the problematical uncinate (archaic rhabdodiactin? see footnote on p. 6), the rhabdodiactin appears to be of an exceedingly rare occurrence in the Dictyonina (Hexactinosa and Lychniscosa). In fact, almost the only other indubitable cases known of its presence are those of *Fieldingia lagettoides*, from among the loose spicules of which F. E. Schulze (1887, p. 336; pl. XCVII, fig. 8) has described peculiar small rhabdodiactins with a central tyle or four cruciately disposed knobs, and of *Aulocystis zitteli* from the Philippines, in which, according to the same author (1887, p. 363; 1900*b*, p. 8), slender rhabdodiactins should occur in the capsular covering layer.

As a sort of small prostal spicules there is a very common occurrence of monactins [1]) exhibiting peculiar secondary developments at that end which represents the morphological centre of the spicule. They are all spicules which, on completed development, project out of the sponge surface, both dermal and gastral, with the end just referred to (the head end), similarly as the likewise monactine "sceptre" peculiar to the Pheronematidae. The monactins in question of the Hexactinosa I propose to refer to generally by the name of the sceptrule. The sceptrule is distinguishable into four varieties, viz., the clavule, the lonchiole (n. n.), the sarule, and the scopule.

Of the clavule, found to be confined to the Farreidae, one may again distinguish several closely related subvarieties, of which the principal ones are as follows: The smooth-clavate (pl. XI, figs. 8—11, 17), which gradates over into the more slender-headed anguilliform (pl. XI, fig. 15) as well as into the pileate (pl. XI, figs. 7, 26); the cusped-clavate (pl. XII, figs. 5, 6) with small cusp-like processes on the apical end of head; the pileate (pl. X, figs. 6, 10; pl. XI, figs. 5, 6, etc.) with subconical or watchglass-like cap, margined with teeth, on the head end; the anchorate (pl. X, figs. 7, 11; pl. XI, fig. 4; etc.) with a whorl of prolonged recurved teeth at the head end, which whorl may sometimes be spirally twisted (the spiroanchorate, pl. XIII, figs. 13—15). In all the clavules the axial canal traversing right through the whole length of the shaft terminates, very close to the apex of head, with a small axial cross, of which the apical arm and the four transverse arms are equally short, indicating the atrophy of the apical ray being as complete as that of the four cruciate rays vertical to the long axis of the spicule (pl. XI, figs. 5—11; pl. XII, fig. 6).

---

1) Monactins derived from the hexactin by disappearance of five of its rays, there thus remaining to the spicule a single ray together with the spicular centre situated at its one end and containing the small axial cross. The cross consists of one apical and four transverse, very short arms, and of a sixth arm opposite the apical, prolonged into, and traversing right through, the whole length of the persistent ray as its axial canal. Supposing the same reducing influence as that which transformed the hexactin into the monactin continued to act upon the latter, the next part to disappear will presumably be its single ray, and the last to do so would be the spicular central node at its one end.

The lonchiole, characteristic of the new and yet undescribed Farreid genus *Lonchiphora* (Ij.), is a spicule slender throughout and consisting of a shaft, the monactin ray, with the terminally situated spicular centre indicated by a small external swelling, from which arises a short, straight and spine-like process directed away from it in the prolongation of the shaft axis. The spicule may therefore appear at first sight like a strongly anisoactine rhabdodiactin. But by proper treatment it is easy to observe that what appears as the incomparably shorter ray is not a true ray (actine), but a solid process into which the apical arm of the central axial cross does not extend.

The sarule, thus far known from only the two Farreid genera *Sarostegia* and *Claviscopulia*, has a swollen head provided with spines which give it an appearance more or less like that of the bushy end of a besom. The axial cross is situated in the base of the spiniferous portion of the head at some distance from the apex, notably differing in this respect from either the clavule or the scopule, both which exhibit it very close to the apical end. In the details of the axial cross there seems to exist a slight but noteworthy difference between the sarule of *Sarostegia* and that of *Claviscopulia*.

My own observations on the sarule of *Sarostegia oculata*, a specimen of which was kindly given me by Professor Topsent, the original describer of the genus and species, has led to the result that the apical arm of the axial cross is as short as any of the transverse arms and does not extend into the apical spiniferous portion of the head. This indicates the confirmedly monactine character of the spicule and at the same time also that the spiniferous apical portion, together with the spines, is of the nature of a secondary addition to the monactin, comparable to the apical process of the lonchiole or the head branches of the scopule. — On the other hand, the sarule of *Claviscopulia* was figured by F. E. Schulze (1899*a*, Taf. XVI, Fig. 4—7) as having the apical arm of the axial cross distinctly longer than the transverse arms and extending well into the spiniferous apical portion of the head. This may be taken for an indication that there exists in this case the last trace of the distal spicular ray and that the entire spicule can be regarded as an extremely anisoactine rhabdodiactin on the verge of changing into a genuine monactin. — As regards the genetic relation of the *Sarostegia* sarule and the *Claviscopulia* sarule, the difference indicated as existing between them, important though it is in certain bearing, seems yet too slight to warrant the assumption of their independent origin, the former from the simple monactin (say, like the clavate or the anguilliform clavule) by acquisition of the spiniferous apical portion ahead of the spicular centre and the latter from a rhabdodiactine prototype of sceptrule by excessive shortening of the distal ray. The derivation of the *Claviscopulia* sarule from the *Sarostegia* sarule, which would imply the reversion of the monactin into the diactin, can scarcely be thought of. After all, then, the most probable assumption seems to be the reverse of the above, viz., that the *Sarostegia* sarule was derived from the anisodiactine sarule like that of *Claviscopulia* by complete disappearance of the last vestige of the distal ray. I am greatly inclined to think that we have here to deal with a case analogous to that of the basal anchoring spicules of the Euplectellinae, which in many genera (as, f. i., in *Euplectella*, *Holascus*) are anisoactine rhabdodiactins showing the axial cross some distance above the anchor knob, but are in certain other genera (f.i., *Acœlocalyx*, *Docosaccus*, *Holascella*) genuine monactins with axial cross situated in the anchor knob and apparently derived from the anisodiactine form

by complete atrophy of the shorter ray but not of the terminal anchor knob that now contains the axial cross. As still another case of a similar nature may be given the shortening or atrophy of principals in certain hexasters, which process is not shared by the terminals.

Topsent (1904*a* p. 2) has opined that the sarule of *Sarostegia* and *Claviscopulia* is found in a simplified form in *Farrea clavigera* F. E. Sch. Evidently he holds the smooth-clavate clavule of that species right off for the sarule without the spines. Probable as is the derivation of the clavule in general indirectly from the sarule, I think it yet not readily admissible that the latter, thought of as deprived merely of the spines, is morphologically exactly equivalent to the smooth-clavate clavule. This is owing to the axial cross being situated in different parts of the head in the two spicule sorts, which fact attests to a difference in morphological nature of the head swellings (see a n t e). On the other hand, the smooth-clavate clavule is closely and inseparably linked together with other varieties of clavules by the constant situation of the axial cross at the head apex as well as by the occurrence of intermediate forms representing transitional stages of external shape. Therefore it follows that that spicule should properly be held in distinction from the sarule. In passing, it may be noted that Topsent, as a consequence of his classing the smooth-clavate clavule of *Farrea clavigera* with the sarule, has transferred that species into the genus *Claviscopulia* F. E. Sch. characterized by the conjoint presence of the clavule and the sarule, — a procedure which, in my opinion, was a mis-step.

The *scopule* (pl. XIV, figs. 6, 7, etc.; pl. XV, figs. 3—6, etc.) is known from the Euretidae, the Tretodictyidae and the Aphrocallistidae. It may be held for certain that it does not occur in all the Farreidae, and also in the Aulocalycidae, except *Fieldingia* which is referred to that family with some doubt and is known to be in possession of the scopule. Its absence in the Farreidae is probably an a b o r i g i n e character of the family, while that in the Aulocalycidae, as also the same negative character of certain Euretid genus (as, f. i., *Margaritella*, with the single species *M. coeloptychioides*, studied by both F. E. Schulze [1887] and H. V. Wilson [1902] on specimens with loose spicules), may be considered to be due to disappearance of the spicule from secondary loss during the phylogeny of the forms concerned. With regard to the Craticularidae, the presence or absence of the scopule cannot be definitely determined owing to all the members of the family being as yet known from dictyonal skeletons only. Nevertheless, I am greatly inclined, in consideration of the general condition of its dictyonal structure being more in agreement with that of the Euretidae than of the Farreidae, to assume the presence of scopule in the Craticularidae, and if that be not actually the case, anyway to assume the derivation of the family from an ancestral form which possessed either the scopule or the immediately preceding protype of the scopule. It is on the basis of that assumption that I provisionally range the Craticularidae under the subtribe Scopularia.

As to the morphological nature of the branches at the head end of the scopule, there can be no doubt whatever of their being, not primary holactin rays or actins, but secondary processes, comparable to the terminals of hexasters, as was correctly pointed out by F. E. Schulze (1887, p. 34). The entire spicule that author was inclined to regard as a diactin or a monactin. According to H. V. Wilson (1904, p. 86) it should correspond to a diactin with one long ray (the shaft) and one exceedingly short ray which is produced into the branches. My own observations on scopules from numerous species decidedly tend to prove that the spicule is a

confirmed monactin (see footnote on p. 123) like the clavule, the lonchiole or the *Sarostegia* sarule. Apart from the branches at the head end, it consists of the swollen spicular centre directly bearing those branches and of a single simple ray, the shaft, traversed by the axial canal throughout its length. The small axial cross, contained in the terminal spicular centre has the four transverse arms and the apical arm equally very short (pl. XVIII, figs. 10, 17), which indicates an atrophy of all the five rays (actins) in relation to those arms of the axial cross to the utmost or final degree. v. LENDENFELD (1915, p. 148) has given that the scopules are likely "apically highly differentiated hemihexasters", an idea which was previously hinted at by F. E. SCHULZE (1899*a*, p. 109). For my part, I simply see no call whatever for bringing the hexaster or the hemihexaster into consideration in the question of the origin of the scopule or any other form of the sceptrule.

With the scopule was directly classed together the sarule of *Claviscopulia* by F. E. SCHULZE (1899*a*, 1904). This was regarded by him (1899*a*, pp. 77, 108) as a peculiarly developed, or a relatively primitive besom-like scopule. It can readily be admitted that the sarule is probably to be considered as the primitive form of sceptrule from which were derived the scopule as well as the lonchiole and the clavule. The monactine sarule of *Sarostegia*, rather than the almost diactine sarule of *Claviscopulia*, suggests itself as the nearest known prototype of the scopule which is, as already stated, always a genuine monactin. Even so, there still exists between the sarule and the scopule a morphological disparity which, slight though it is, is yet sufficiently significant of the fact that the two should not be indiscriminately thrown together. The disparity referred to is in the main the same as that which I have taken for the ground in objecting to TOPSENT's calling the smooth-clavate clavule of *Farrea clavigera* a sarule. In fact, I am of the view that the sarule cannot be said to be exactly on a par with the scopule till it shall have lost the apical accessory bulb, lying ahead of the position of the axial cross, but retaining the spines which should then come to spring out directly from the swelling of the terminally situated spicular centre, as do always the head branches of the scopule. To be sure, I regard the scopule as a derivative from the monactine sarule like that of *Sarostegia*, and the sarule itself as one from a primitive anisodiactine form of the sceptrule, as indicated by the sarule of *Claviscopulia*.

The point here laid down with regard to the phylogenetic relation of the sarule to the scopule is of importance on the systematic of the Hexactinosa. F. E. SCHULZE, at the time he first described his *Claviscopulia* (possessing both the clavule and the sarule, the latter alleged by him to be a form of the clavule), remarked that the gap between the Clavularia and the Scopularia was considerably lessened by the discovery of that genus, but he seemed to be in hesitation to decide if thereby the Farreidae, representing the former group, were brought near enough to the Euretidae, of the latter, to justify the union of the two families into one. To provide for the case they should prove tenable, he gave definitions of both (1899*a*, p. 109). In the "Valdivia" Report (1904), F. E. SCHULZE declared that the discovery of *Claviscopulia* has made the boundary vanish between the said families and that they must therefore be united into one, the Euretidae in ZITTEL's (1877) sense. As a matter of course, then, the distinction between the Clavularia and the Scopularia was to be considered to have altogether fallen through. Whether the above union of the two families is justifiable hinges largely on the question if the

sarule can be identified as one of the sarules or not. Now, in as much as I regard the scopule, as before explained, as a well characterized form of the sceptrule to be held in distinction, though in a way derivable, from the sarule, I have been led to think that all the Hexactinosan families provided with the scopule, have descended from a common ancestral form which had the sarule (particularly the strictly monactine sarule like that of *Sarastegia*) or a sceptrule form intermediate in characterization between it and the scopule. Those scopuliferous families may then be regarded to form a natural group within the Hexactinosa, for which F. E. SCHULZE's designation Scopularia appears an appropriate one. Of that group I look upon the Euretidae F. E. SCH. as forming the trunk, and the Tretodictyidae and the Aphrocallistidae, to which may probably be added the Aulocalycidae and the Craticularidae, as representing as many independent side-branches from that trunk which have differentiated at early periods of the phylogeny. On the other hand, the genera *Sarostegia*, *Claviscopulia*, *Lonchiphora* and *Farrea*, which remain of the Hexactinosa after deducting from it all those forms referrible to the Scopularia, appear unitable into one family: the Farreidae, in view of their fargoing agreement in the structure of dictyonal framework and of the complete absence of canals in same. The sceptrule in the family is indeed various; it varies from the sarule to the lonchiole and the clavule, but is never the scopule as I take it. The family may therefore be made, I think, to stand as the counter-group, the Clavularia F. E. SCH., to the Scopularia (s. emend.). After all, it will be seen that the position I have taken is in agreement with the earlier view F. E. SCHULZE's in keeping up the Farreidae as a family distinct from the Euretidae, and in giving it at the same time the status of a group next higher in systematic grade (Clavularia), as against another group (Scopularia) which includes the latter family; but with this difference that the second group referred to differs considerably in scope as conceived by him and by me. As regards the relation between his Farreidae and Euretidae, F. E. SCHULZE has indicated in 1899 (*a*, p. 109) that they may be regarded to represent two diverging branches from a common stem in which the clavule and the scopule were yet undifferentiated, but which had in their stead certain needle forms representing pre-sarular developmental stages of the sceptrule, or had at the most the sarule itself. I conceive the Clavularia and the Scopularia to have differentiated in exactly that way (see the genealogical representation of Hexactinosan families given on p. 129). Moreover, it may be noted that, before me, TOPSENT (1904*a*) has maintained the distinction between the Clavularia and the Scopularia, holding the sarule and the scopule to belong to different categories of spicules. In this, so far as the matter goes, I concur in the essential point.

Finally, the uncinate. On the morphological status of this spicule and its distribution in the recent Hexactinellida I have already had occasion to dwell at some length (p. 6). Under the Hexasterophora it is found in confinement to the Hexactinosa, but not in all of that tribe. It is known from the Farreidae, the Euretidae, the Tretodictyidae and the Aphrocallistidae. It probably occurs also in a part of the Aulocalycidae, but apparently not in *Aulocalyx* and *Euryplegma* of that family. Under the Euretidae, *Margaritella* is exceptional in that it lacks the uncinate together with the scopule (see ante). Where amongst the Hexactinosa the spicule in question really does occur, the absence is, as before mentioned, to be explained by assuming its secondary loss during the phylogeny, as is also the absence of same in the tribes Lychniscosa and Lyssacinosa (p. 112). *Dactylocalyx* and *Myliusia*, both insufficiently known

genera, now referred by me to the Euretidae, were at one time placed by F. E. SCHULZE under his *Inermia* which should be without the uncinate; but critical examination of the literature (BOWERBANK 1869, CARTER 1873, SOLLAS 1879, O. SCHMIDT 1880) tends to show the mistake, or at any rate the prematureness, of definitely concluding that both the genera are without the uncinate.

Here may attention be called to the fact that, in the Hexactinosa, the uncinate frequently occurs in a nearly or perfectly smooth state devoid of the barbs, a fact which has already been recognized by TOPSENT (1904 *b*, *c*, *d*). The morphological identity of the barbless amphioxes with the typical uncinate is proved beyond doubt by the existence of transitional forms leading one over into the other, supplemented in some cases by the identical manner of occurrence in the sponge body. Where barbless uncinates have been observed, they usually stand referred to in the literature as diactins without an indication of their relation to the uncinate. TOPSENT (l. c.) called them "soies diactinales", regarding the same to be simplified uncinates. From previous records and my own observations, it can be said that fine uncinates which have lost the barbs, occur in certain species of *Pararete, Tretodictyum* and *Hexactinella*, and also in all the known species of *Gymnorete* and *Auloplax*.

Differential key to families of the Hexactinosa.

A. Sceptrule in the form of sarule, lonchiole or clavule. (Skeleton not canalized; fundamentally and generally quadrangular-meshed, though irregularities in this respect may arise, owing to accretion of later formed skeletal hexactins in indefinite orientation). Subtribe Clavularia F. E. Sch. . . . . FARREIDAE F. E. Sch.

B. Sceptrule in the form of scopule, or entirely absent. Subtribe Scopularia F. E. Sch., s. ext.

a^1. Skeleton not canalized, or with canals other than diarhysis.

a^2. Skeletal meshes predominantly irregular-shaped and widely varying in dimensions; the framework made up of hexactins with rays, frequently much elongated and curved, intersecting one another in various angles and coming into fusion at points of intersection or where they come into lateral apposition or terminate in abutment on others; proximately running rays frequently connected by synapticulae. Without canals, except extradictyonal epirhysis and aporhysis which may occur . . . . . AULOCALYCIDAE n. fam.

b^2. Skeletal meshes may be present as regularly quadrangular-meshed as in A, but are frequently triangular or somewhat irregular in shape; the framework made up of hexactins with straight rays usually not longer than the side they form of the mesh.

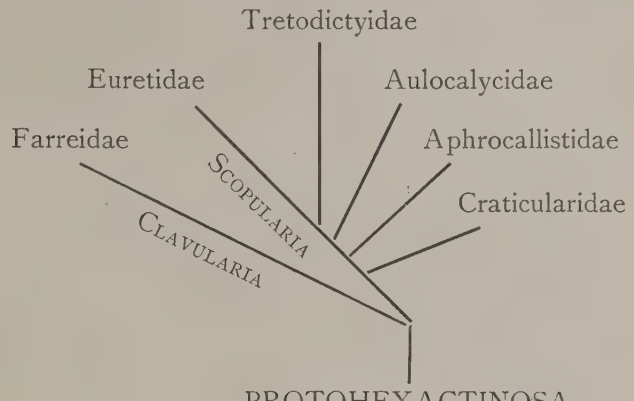
a^3. Without canals, or showing at most either amararhysis or epirhytic depressions but not aporhysis . . . . EURETIDAE F. E. Sch.

b^3. With schizorhysis . . . . . Tretodictyidae F. E. Sch.

c^3. With simultaneously occurring systems of epirhysis and aporhysis in alternate arrangement and running alongside of each other for a greater or less extent . . Craticularidae Rauff.

b^1. With diarhysis. Dictyonal framework irregular-meshed and made up of hexactins which are either all of nearly the normal development or in part of such a development as to have certain rays so bent, that all the six may lie almost in the plane of interdiarhytic septum . . . . . Aphrocallistidae Gray.

The genealogical relations of the six families may be conceived somewhat as shown below.



Subtribe a. CLAVULARIA F. E. Schulze.

F. E. Schulze, 1886, p. 69; 1887, p. 266. — Topsent, 1904*a*.

Hexactinosa with sceptrule in the form of sarule, lonchiole or clavule, in exclusion of scopule.

Dictyonal skeleton never canalized; fundamentally and generally quadrangular-meshed; consisting of nodes which are all a hexactin centre and from which radiate six internodal beams, these being usually laterally apposed and amalgamated combinations of two rays from adjacent hexactins and not longer than the side of the mesh they bound. Irregularities to the above regularly meshed structure of the skeleton arise, owing to accretion of later formed dictyonal hexactins in indefinite orientation.

With the single family Farreidae.

Family Farreidae F. E. Schulze, 1886.

Farreidae, F. E. Schulze, 1886, p. 69; 1887, pp. 266, 390; 1899*a*, pp. 106—109; 1902, p. 85. — Rauff, 1893, p. 190. — Topsent, 1904*a*.

Euretidae partim, Zittel, 1877. — F. E. Schulze, 1899*a*, p. 68; 1904, p. 177.

With characters of the subtribe.

The Farreids are usually of a tubular habitus, either simple or branched and anastomosing; seldom funnel-like or so developed as to be like a narrow or a broad and irregularly bent plate. The branching tubes, forming a stock, are all of an approximately equal width, each terminal branch ending with an osculum.

The regularly quadrangular-meshed dictyonal latticework may be single-layered at the commencement of its existence and may later become many-layered by addition of a new layer or layers on the outside. This holds true for the genus *Farrea*, but probably not for all the genera of the family. So that, that character seems unfit to be used, as was done by F. E. SCHULZE (1904), though with reserve, as a point of distinction of the family as against the Euretidae having the latticework many-layered from the origin.

The dermalia and gastralia are always pentactins in which the atrophied sixth (distal) ray may be represented by a mere swelling or a peg-like rudiment. Of a very wide distribution in the family is the oxyhexaster — which seldom takes the form of the tylohexaster — with moderately long principals and strongly divergent terminals, occurring alone in most cases but occasionally in company with the discohexaster with short principals. Rarely the discohexaster may be the only form of hexaster present. The uncinate is constantly present.

The fossil Callibrochidae, one of SCHRAMMEN's (1910—12) Hexactinosa incertae sedis, is possibly to be taken under the Farreidae.

Differential key to recent genera of the Farreidae.

A. Sceptrule all or in part in the form of sarule.
   - a^1. Sarule and pileate clavule on dermal side; anchorate clavule on gastral side. . . . . **Claviscopulia** F. E. Sch., 1899.
   - b^1. Sarule only on dermal side; without sceptrule of any sort on gastral side. . . . . **Sarostegia** Tops. [1]), 1904.

B. Sceptrule in the form of lonchiole or clavule; none in that of sarule. Clavule of gastral side usually but not always anchorate.
   - c^1. Lonchiole only on dermal side . . . . . **Lonchiphora** n. g. (Ij. MS.).
   - d^1. Clavule of varying forms on dermal side . . . . **Farrea** Bwbk., 1862.

The "Siboga" collection contains ten species and subspecies of *Farrea*, besides some Farreid specimens which can not be exactly determined.

Genus **Farrea** Bowerbank, 1862.

Farrea Bowerbank, 1862, p. 1118; 1864, p. 204. — CARTER, 1885. — F. E. Schulze, 1887, pp. 266, 390; 1902, p. 85; 1904, p. 142.
Aulodictyon S. Kent, 1870, p. 249.

Farreids forming stock which consists of dichotomously branching tubes with tendency to anastomose, or of an erect stem-tube with lateral oscula or short branches in alternately

1) With *Sarostegia* is probably identical F. E. SCHULZE's *Ramella* (*R. tubulosa* F. E. Sch., 1904, pp. 38, 144).

opposite or spiral arrangement; all free branches approximately the same in diametre and each ending with osculum. Dictyonal wall, at first thin and made up of dictyonal hexactins in a single layer, may grow later to a moderate thickness by an addition of similar hexactin layer or layers on the outside of the one already present. Dictyonal meshes primarily and fundamentally more or less regularly quadrangular or cubic in shape and moderately large, but may secondarily become irregular and closer, owing to interposition of more dictyonal hexactins in indefinite orientation to the primary meshes. Dermalia and gastralia pentactine. Of a nearly constant occurrence is the oxyhexaster — sometimes in the form of tylohexaster — with relatively long principals and strongly divergent terminals.

Of Farreas which were described in sufficient detail to admit of recognition, there have hitherto existed twelve forms, irrespective if these having been presented as species, subspecies or varieties by the authors. In the rich *Farrea* material collected by the "Siboga" I have distinguished nine forms, of which all, except one (*F. clavigera* F. E. Sch., regarded in this report as a subspecies of *F. occa*), seem to be new. Besides, I have included in this report the description of a new species (*F. hanitschi*) which was obtained by Mr. MACLEAR LADDS in Timor Sea. So that, the number of recognizable *Farrea* forms has increased to twenty-one. (For an enumeration of the forms, see the list at the end of this report).

Six of the *Farrea* forms obtained by the "Siboga", I have made subspecies of *F. occa*. I deem it highly probable that a number of the forms now standing as distinct species in the literature, as, f. i., *F. aculeata* F. E. Sch., *F. convolvulus* F. E. Sch., *F. vosmaeri* F. E. Sch., may have to be placed under *F. occa* in the future. The typical form of *F. occa*, or *F. occa occa* as it may be called trinomially, does not exist in the "Siboga" collection. It may therefore not be out of place to make here a brief observation on that form, for the sake of comparison with my descriptions of other forms of the same species from the "Siboga" material.

Farrea occa occa Carter. — A definite conception of the form, entitled to the name *F. occa occa*, was given by CARTER in 1885. All the earlier records of *F. occa* Bwbk. (1862) have reference to completely washed-out skeletons only and may be said to be quite unreliable, except in their bearing on the genus. It is now known that *F. occa* Bwbk. is of an extremely wide and well-nigh cosmopolitan distribution. Conceiving, as I do, this manifestly very variable species to be made up of several subspecies, it becomes a little uncertain if the specimens from different parts of the world that have hitherto been referred to it in an unrestricted sense, can all be placed under, and their localities be regarded as those of, *F. occa occa* Carter. Be that as it may, Sagami Sea, whence came the specimen described by CARTER, stands settled as a locality for that (typical) form of the species. Now, as the result of a renewed study of a number of what I take for indubitable *F. occa occa* from that very locality, I may put down the more outstanding characters and the range of variation of that form as follows:

Stock of a clumpy or irregular shape, consisting of dichotomously branching and anastomosing tubes up to 10—15 mm. in diametre. Tube wall in most parts thin and elastic, supported by a single-layered dictyonal latticework with quadrangular meshes and with tubercled elongate-conical spikes arising, one from each node, on both sides of the layer like the prongs of a harrow. In the lower parts of the stock, the dictyonal latticework may be two-layered and is moreover strengthened by an addition, especially on the outer surface, of secondary dictyonal

beams which run in indefinite directions. Small dictyonal oxyhexactins are found attached to beams in varying numbers. — Dermal pentactin with paratangential rays sometimes weakly rough all over, sometimes pronouncedly tubercled on their outer side and at still other times set on that side with a sparse number of conical and vertically standing spines. — Gastral pentactin with paratangentials always showing some prominent tubercles or vertical spines on their outer side. — Dermal clavule pileate, with pilear disc which may be flatly convex like a watch-glass or more or less subconically elevated with or without an indication of an umbo-like prominence at the apex; marginal teeth up to 20 or thereabout in number. — Gastral clavule pileate like the dermal, but with a fewer number of slightly larger marginal teeth. In some individuals there may occur in addition some anchorate clavules with 4, 5 or 6 anchor hooks, and leading over gradationally into the pileate clavule of the same side. — In certain individuals there may sporadically occur a third kind of clavule in which the head is a club-shaped swelling without teeth as in the smooth-clavate clavule of *F. clavigera* and *F. occa claviformis*. In *F. occa occa* that form of clavule, if present at all, occurs in but a limited number and that generally close to the oscular margin, either on the dermal side alone or on both dermal and gastral sides. — Oxyhexaster 50—77 μ in diametre, with principals about as long as, or longer than, the terminals in the same spicule. Hemi-oxyhexaster not observed. In some individuals there is an occasional occurrence, in a limited number, of the tylohexaster which differs in no way from the oxyhexaster, except in the terminals showing each an indication of a minute terminal knob. — Uncinates of various sizes present, without characterization of diagnostic value.

1. *Farrea occa erecta* n. subsp. (Plate X, figs. 1—12; ? figs. 13—16).

Stat. 122. 1° 58′.5 N., 125° 0′.5 E. 1264—1165 m. Fragmentary or otherwise incomplete specimens.
Stat. 177. 2° 24′.5 S., 129° 38′.5 E. 1633 m. Fragmentary specimen.
Stat. 220. Off W. coast of Binongka I., Banda Sea. 278 m. 1 specimen.
Stat. 226. 5° 26′.7 S., 127° 36′.5 E. 1595 m. Fragmentary specimens.
Stat. 280. 8° 17′.4 S., 127° 30′.7 E. 1224 m. Fragmentary specimen.

Diagnosis. — Differing from *F. occa occa* chiefly in the stock, consisting of an erect tubular stem with lateral oscula or short branches which are usually arranged in alternate disposition on opposite sides; in the thicker and rigid wall which, in all or nearly all parts of the stock is supported by a dictyonal framework, regularly rectangular-meshed in the innermost layer but irregularly dense-meshed in the outer parts; in the external surface frequently showing vaguely marked ridge-like elevations; in the frequent occurrence of a longitudinal falcate crest in the axilla-like concavity between every two lateral branches of the same side (interoscular carina marking the line in which the oscular margin came into fusion at completion of the division of an osculum into two); and in the larger size of oxyhexasters (diametre generally over 80 μ and up to 100 μ or 124 μ or even more) with terminals, about as long as, or shorter than, principals. The oxyhexaster may occasionally be hemihexasterous. Tylohexaster may also occasionally occur, but is an element of quite inconstant presence. Dermalia with paratangential rays simply rough-surfaced or provided on the outer side with a sparse number of distinct vertical spines, as are those of gastralia always. Dermal clavules pileate. Gastral clavules

anchorate, with anchor-hooks generally 10—4 in number. In the upper parts the stem-tube may reach a diametre of 20 mm. The wall close to oscular margin may be 1 mm. or more, sometimes even 2 mm., thick; it is thicker at the basal end of stem.

Description. — The numerous, but mostly fragmentary, specimens, here brought together under the new subspecies *erecta* are by no means uniform in their characterization. A number of specimens from different localities require to be described in special.

Stat. 220 (W. coast of Binongka I., Banda Sea). The single specimen (A) obtained at this locality, which I make the type of the subspecies, is an erect and nearly complete stock of a simple shape and a moderately large size. It is shown in Plate X, fig. 1. The stem-tube, which probably stood erect on the substratum, is broken off at the lower end, presumably at a point close to the basal attachment. Height of the specimen 122 mm. Terminal osculum 17—20 mm. in diametre; stem-tube in the middle 13—14 mm. and at the lower end about 9 mm. in diameter. Thickness of wall a short distance below terminal osculum 1 mm.; same at the lower end of stem 2 mm. or more. The wall is firm or moderately firm, right up to the oscular margin. The broad, short and simple lateral branches, of which there are eight in all, terminate each with an osculum. They are arranged not alternately in two opposite rows as they usually are in other specimens, but in a spiral line around the stem. Another noteworthy point of the specimen consists in the fact that the entire dermal surface is even and does not exhibit any ridge-like prominences, excepting an inconspicuous interoscular carina above the second lateral branch as counted from the upper end. It may be that the evenness of the external surface is due to the not fully mature state of the specimen, in which the skeletal wall has not yet attained its full development. The wall of the specimen may be said to be relatively thin in comparison with that of most other specimens referred to the same subspecies; so that, in the wet state the regularly lattice-like structure of the skeletal wall can be discerned from the outside nearly throughout the entire extent of the specimen.

The dictyonal latticework occurs in a single layer in the youngest parts of the stock, i. e., in regions adjoining oscular margin, but in most other places in two layers (pl. X, fig. 8). Its quadrate or longitudinally elongate rectangular meshes are of various sizes, measuring up to about 800 μ in greatest length. On the outer side of the latticework and in direct connection with it, there occur more dictyonal beams of secondary addition, which, running without definiteness in their direction, bring about an external stratum of irregular-meshed dictyonal network. Such beams are still relatively sparse in the young parts near oscula (fig. 8), but increase in frequency of occurrence and in development towards the stem-tube, and on that towards the base; the mesh-spaces inclosed by them becoming continually smaller at the same time. Thus; in most parts of the stem-tube, but especially in its lower parts, the external surface of the skeletal wall is quite irregular- and small-meshed, and at the basal end presents even a granulated-like appearance, while the inner surface shows, in all parts of the stock, the usual more or less regularly checkered-like structure of the primary dictyonal latticework, owing to the fact that secondary addition of late-formed dictyonal hexactins in irregular orientation does not occur over the gastral surface.

A similar condition of the dictyonal wall exists also in *F. occa occa*, but there the external irregular meshed stratum is limited in extent of occurrence to the basal parts only; so that,

by far the greater part of a stock has the dictyonal skeleton consisting solely of the primary single- or double-layered latticework with quadrangular meshes.

Where the external irregular reticulum of secondary addition is well developed, the beams composing it, may be about 100 μ thick and show a sparse number of microtubercles irregularly distributed on the surface. In all parts of the skeleton the well-known small dictyonal hexactins of 80—175 μ axial length are seen attached in profusion to the beams (fig. 8). The tuberculated spikes on both sides of the dictyonal wall are rather slender and may be $^1/_8$ mm. long.

Dermal pentactins (pl. X, fig. 4) all macrospiny, i. e., provided with paired rays (240—290 μ long and about 11.5 μ thick at base), chiefly on their outer side, with a number (6 or more) of distinct, conical and vertically standing spines; and with proximal unpaired ray (300—500 μ long) somewhat more weakly spiny all around, the spination growing inconspicuous towards the free end. A prominent conical boss exists in place of the atrophied distal ray.

Gastral pentactins like the dermal, but with somewhat more numerous and stronger macrospines (up to nearly 12 μ long) on rays. Paired rays generally 260—400 μ long and about 13 μ thick at base; unpaired distal ray 360—464 μ long.

Dermal clavule (pl. X, fig. 6) with pileate head, 250—330 μ long; the watchglass-like pilear disc 20—26 μ in diametre, with 20—14 small marginal teeth; shaft and subpilear swelling obsoletely rough or nearly smooth. Smooth-clavate clavules were not found.

Gastral clavule (pl. X, fig. 7) as usual less numerous than dermal, 257—288 μ long; generally with anchorate head consisting of 10—7 hooks, 27—42 μ in a line from tip to tip of diametrically opposite hooks. The hooks may be 23 μ long. Seldom the gastral clavule is pileate, like the dermal but on the whole with a less number of marginal teeth.

Oxyhexaster (pl. X, fig. 5) very numerous, 83—120 μ, mostly about 100 μ, in diametre; terminals nearly straight, 2 or 3 (seldom 4) in number to each principal, which is about as long as the terminals borne on it. Occasionally the oxyhexaster is in the form of hemihexaster; and certain small six-rayed spicules, not rarely found in association with it, I take to be hexactinoid oxyhexasters. Disco- or tylo-hexaster not found.

The uncinate is very scantily present, at least in the major part of the stock. One of the longest uncinates observed (800 μ long and 8 μ thick), looked very much like a similar-sized one from *F. occa occa*, being set with a rather sparse number of slender barbs diverging well away from the shaft surface. Small uncinates, about 0.5 mm. long and scarcely 5 μ thick, showed only an indication of barbs in the serration of lateral countour lines.

Stat. 226 (between Schildpad and Lucipara Is., Banda Sea). Out of the numerous, more or less imcomplete specimens of *Farrea*, obtained at this locality, at least two (specimens B and C) may be referred to *F. occa erecta*. Of the others, some can be identified with *F. occa clavigera* F. E. Sch., while all the rest are dead and water-worn specimens which, though presumably belonging to either *erecta* or *clavigera*, can not be definitely determined. In plate X, fig. 16, is shown the largest specimen of the last lot, in illustration of the characteristic habitus exhibited by both the subspecies mentioned or by many Indo-Malayan forms of the species.

Specimen B consists of a few fragments, one of which apparently represents the upper end (18 mm. diametre) of a stem-tube. The wall is thin, elastic, and externally even-surfaced.

The spicules agree quite with those of specimen A, not excepting the fact that the dermal pentactin is macrospiny in about the same manner and degree as in that specimen.

Specimen C is an indefinitely shaped, short, tubular fragment of a large calibre (18 mm. or less in diametre), with well-preserved skeletal elements and standing at two places of its wall in fusion with old dead stem-tube of another *Farrea* individual by means of pedicle-like processes. The specimen is visible on the left side of fig. 3, pl. X. The wall is fully 2 mm. or even 2.5 mm. thick in some places. It is rigid and shows on the dermal surface some low but distinct, irregularly or longitudinally running ridges. — The dermalia (pl. X, fig. 9) has rays which are weakly microtubercled all over. The microtubercles are most pronounced on the outer surface of paired rays; there they may appear as vertical spinules, which are however never so prominently developed as we have seen them to be on the dermalia of specimens A and B. Here we seem to have before us a state of dermalia intermediate between that in which the paired rays are macrospiny as in the specimens just referred to, and that in certain other specimens in which the same rays, as also the unpaired ray, are simply faintly rough or nearly smooth throughout. The paired rays are 200—260 μ long. — The gastralia (pl. X, fig. 12) have the paired rays as usual sparsely macrospiny on their outer side. The unpaired ray is simply weakly tubercled like the same ray of dermalia. — The pileate dermal clavule (fig. 10) has the pilear disc of a more or less conical shape, about 30 μ in diametre and provided with marginal teeth up to 19 or 20 in number; the subpilear thickening with a number of tubercles, which are frequently arranged in a row around it and thus appear to form a second circle of teeth below that of the pilear margin. — The anchorate gastral clavule (fig. 11) has the anchor composed of 4—8 claw-like hooks. The thin shaft may reach 360 μ in length. — The oxyhexaster is very numerous as in specimens A and B; 90—120 μ or over in diametre; terminals 2 or 3 to each principal, about as long as or shorter than this. Hemioxyhexasters are not at all rare.

Stat. 177 (Ceram Sea). Among the numerous *Farrea* pieces from this station, there are some (specimen D) which have preserved the loose spicules and can be identified with the subspecies *erecta*. In general habitus they are much like specimen A, but differ somewhat from it in having lateral oscula alternately arranged on the stem-tube in two opposite longitudinal series, in showing indications of external ridges on the wall, and in the frequent occurrence of interoscular carinae. The stem-tube is under 15 mm. in diametre; the wall 1—2 mm. thick; the gastral surface exhibiting a rectangular-meshed lattice-like structure; the dermal surface irregularly reticular, in the lower parts of the specimens finely porous. The loose spicules are nearly completely like those of specimen C from Stat. 226. As in that specimen the dermalia is simply rough-surfaced, and the dermal clavule frequently shows on the subpilear thickening a second circle of teeth below the first, formed by those of pilear margin. As rare occurrences the dermal clavule has the head entirely devoid of teeth and elongate-ovoid in shape (smooth-clavate). Oxyhexasters measure 72—100 μ in diametre. In most of them the terminals are distinctly shorter than the principal.

All the remaining pieces obtained at the same station are completely washed-out fragments, agreeing with the above in the character of the dictyonal skeleton. The thick and firm wall exhibits distinctly developed ridges on the external surface. Like as the fragments seem to be

erecta, I should rather leave the point undecided in the absence of the loose spicules necessary for exact identification.

Stat. 122 (off northern end of Celebes). Of the numerous *Farrea* specimens obtained at this spot only two (specimens E and F) are in a fairly good state of preservation and can safely be ascribed to the subspecies *erecta*, while all the rest are dead and macerated specimens.

Specimen E is the fragmentary piece shown in pl. X, fig. 2. In it the ridges of the external surface are weakly developed, while interoscular carinae are quite distinct, appearing like a low keel-like ridge. The stem-tube bears some short alternately opposite lateral branches. Characteristic of these branches is the fact that the wall is but little developed in their inferior parts, while in their supero-lateral parts it is much more extensively developed; the result being that the branches show a downward curvature, which makes the osculum at their end open in the downward direction. The dictyonal skeleton, viewed on the gastral surface, is as usual quadrangularly meshed, the intersecting beams measuring about 60 μ in thickness and the meshes up to 500 μ long by a width of 200—300 μ. The same lattice-like structure is also observable on the dermal side to a certain extent; but in most parts of this side the regularity of the checker-like pattern appears more or less disturbed by the addition of dictyonal beams which run without definiteness in their direction. In some places of the external surface the dictyonal meshes are thereby rendered very small. Some of the secondarily added superficial beams may be nearly as thick as 100 μ, and the thicker of them may show a sparse tuberculation on surface.

Of the loose spicules the following observation was made. Dermalia with all rays faintly rough or even nearly smooth throughout; the paired rays generally 200—270 μ long and 9.5—13 μ thick at base; the proximal ray about as long. Gastralia similar to dermalia, but with the paired rays sparsely macrotubercled chiefly on the outer side of their surface. Dermal clavule pileate, 258—288 μ long; the conical cap 19—26 in diametre, with 17—25 marginal teeth; the subpilear thickening often, but not always showing an indication of a circle of teeth or tubercles. Rarely there exist some dermal clavules which have lost the pileate appearance and the marginal teeth, and have a head of an ovoid shape and perfectly smooth surface. Gastral clavule less numerous than dermal as usual, about as long as the latter, mostly anchorate with 4 and sometimes only 3 anchor-hooks, measuring 34 μ in direct line from tip to tip of opposite hooks. Occasionally there occur pileate gastral clavules with 12 or a less number of marginal teeth. Oxyhexaster 80—134 μ in diametre, sometimes longer in one axis than in others terminals 2 or 3 to each principal, sometimes about as long as, but generally distinctly and often very much shorter than, the latter. Hemioxyhexaster exceedingly rare. Tylohexaster not discovered, a fact which is here specially mentioned, since the same station has yielded the type of *F. occa ouwensi* characterized by having the tylohexaster instead of the oxyhexaster. The uncinate is of the usual appearance; it is of varying dimensions up to 1.5 mm. long and 7.75 mm. thick.

Specimen F is of much the same dimensions and macroscopic appearance as the above described specimen; only, the arrangement of lateral oscula is not strictly biserial, but somewhat approaches a spiral as in specimen A. The spiculation is in most respects nearly identical with that of specimen C (Stat. 226) or of specimen D (Stat. 177). As in specimens D and E, there is here again an occurrence on the dermal side, in addition to the usual pileate clavule, of

that form of clavules in which the entire head is ovoid or oblong-ovoid in shape and perfectly smooth-surfaced. This form of dermal clavule was found at certain places in fair abundance, but is on the whole by far the less numerous of the two, being generally found in rare sprinkling among the pileate kind. Pileate dermal clavule 270—330 μ long; the subconical cap with toothed margin 26—30 μ in diametre. Smooth-headed form of same 380—443 μ long; the head 19—23 μ in greatest breadth, either simply rounded on top or showing an indication of an apical knob. Gastral clavule generally anchorate with 8—4 anchor hooks; rarely pileate or even smooth-headed like the dermal. — In the not uncommon presence of the smooth-headed clavule the above described specimen greatly approaches the character of *F. occa clavigera*. In fact, the two subspecies, *erecta* and *clavigera*, seem to pass over insensibly into each other, the distinctive factor in the intermediate cases consisting probably only in whether the pileate clavule predominates over the smooth-headed in the number of occurrence, or vice versa.

From the same station which yielded the above specimens E and F, there are in the collection several more *Farrea* specimens which are all completely water-washed and therefore can not be precisely determined, though there can be but little doubt of their being probably either *erecta* or *clavigera*. As representatives of this lot of imperfect specimens may be taken the two, shown in figs. 13 and 14, pl. X. Both are strong-walled skeletal tubes of a considerable length and about as thick as one's little finger or thicker, with a number of short lateral branches arranged in alternately opposite disposition and each ending with an osculum. Both the specimens plainly exhibit on the external surface the irregular, but on the whole longitudinally running, ridge-like prominences, and also the more or less distinctly developed interoscular carina between every two lateral oscula of the same side. The wall is at places nearly 2 mm. thick, and that not only in the basal parts but also well up the stem. — The specimen of fig. 14, which is the outside view of the tubular skeleton cut lengthwise into two, is shown in fig. 15 as seen from the inner or gastral side. The two figures should serve to demonstrate the structural difference between the two sides of the skeletal wall. The closely irregular-meshed, or even finely porous-looking, character of the external side is due to the stratum of the irregular dictyonal reticulum, secondarily added to the outside of the primary dictyonal wall with regularly quadrangular meshes, which latter structure always persists on the gastral side of the wall.

Stat. 280 (off eastern end of Timor). Among the *Farrea* fragments from this station, there are some which may be identified with *F. occa erecta*. They seemed to be without the smooth-clavate clavule. Together with those specimens was found one which I should rather refer to *F. occa clavigera*. To which of the two subspecies should be ascribed the completely washed-out fragments from the station, must remain undecided.

2. *Farrea occa clavigera* (F. E. Schulze). (Plate XI, figs. 1—11).

Farrea clavigera F. E. Schulze, 1886, p. 70; 1887, pp. 287, 391, pl. LXXV.
Claviscopulia clavigera Topsent, 1904*a*.

Stat. 226. 5° 26′.7 S., 127° 36′.5 E. 1595 m. 1 specimen & fragments.
Stat. 280. 8° 17′.4 S., 127° 30′.7 E. 1224 m. 1 specimen.

Diagnosis. — Like *F. occa erecta* in habitus of stock, in the structure of dictyonal framework and in characters of most spicules, but characterized by the presence of smooth-clavate

clavules in a number preponderating over the usual pileate clavule. The former 400—567 μ long, with head as thick as 25 μ; the latter 275—350 μ long, with subconical cap and a circle of teeth on subpilear thickening. Gastral clavule generally anchorate, with 8—4 (mostly 4) anchor hooks.

Description. — F. E. SCHULZE's type specimen of *F. clavigera*, which I herewith make a subspecies of *F. occa* Cart., was obtained by the "Challenger" near Banda Is. (Banda Sea, to the south of Ceram). The "Siboga" specimens which seem referable to the same form, were collected at her stations 226 (between Schildpad and Lucipara Islands, Banda Sea) and 280 (off eastern end of Timor), both times together with certain others which I have referred to *F. occa erecta*. If the numerous macerated *Farrea* pieces from the same stations as well as from stations 177 and 122, of all of which specimens mention was already made under that subspecies, also comprised the subspecies *clavigera*, must remain undecided, though it is quite possible that they did.

From Stat. 226 there is at least one incomplete specimen of a considerable size, besides some fragments, which can be regarded to represent *F. occa clavigera*. The specimen (pl. XI, fig. 1) is apparently the upper end of large erectstanding stock which, in general appearance, probably closely resembled the type specimen figured by F. E. SCHULZE of *F. clavigera* (Chall. Rep., pl. LXXV, fig. 1). The stem-tube, 18—21 mm. in diametre, terminates above with a large oblong osculum, which is in the first stage of dividing into two. Besides, it bears two short and alternately opposite-standing lateral branches, of which the upper expands somewhat trumpet-like before ending with a large oscular opening, while the lower forks into an upper and a lower, short and very divergent secondary branches, similarly as most branches in F. E. SCHULZE's type specimen seem to do. The upper secondary branch was broken off, almost at its origin; the lower branch is obliquely inferiorly directed. The wall is firm and 1.5—3 mm. thick, which thickness is kept up nearly to the edge of oscula. The external surface shows some low ridges running in the main longitudinally; and rather strongly developed interoscular carinae occur above each of the lateral branches. In these respects the specimen is scarcely distinguishable from certain examples of *F. occa erecta*. In both his figure and description of the type specimen of *F. clavigera*, F. E. SCHULZE has not given the above external prominences. This may be due simply to the fact, that that specimen stood at a relatively early stage of growth, before the development of the prominences.

The thick skeletal framework in all parts of the specimen consists of an irregularly and densely meshed dictyonal reticulum, though, when seen on the gastral surface, the regularly rectangular-meshed lattice-like structure of the innermost and earliest formed layer of the dictyonal wall can be plainly observed. The statements I have made before with regard to the structure of the dictyonal wall of *F. occa erecta*, especially those given on p. 137, in relation to the indeterminable specimen shown in figs. 14 and 15, pl. X, apply just as well to the present specimen.

The dermal pentactin (pl. XI, fig. 2) is characterized nearly as in the specimen (C) of *erecta* from the same station. The paratangential rays, 175—240 μ long, are either nearly uniformly microtubercled all over or show some conical macrospines on the outer side. The type specimen F. E. SCHULZE's should have had the same rays set with some macrotubercles rounded at end. — The gastral pentactin (fig. 3) has the paratangentials 200—258 μ long and

provided on the outer side with a sparse number of small macrospines which are rounded, less commonly pointed, at end.

Dermal clavules are predominantly smooth-clavate, and much less commonly pileate. The smooth-clavate clavules (figs. 8—11), measuring 400—567 μ long, occur at places very numerously together; the smooth-surfaced head is ovoid, elongate-ovoid or nearly spindle-like in shape and up to 25 μ in greatest breadth. The head form, shown in fig. 10, is the one most commonly met with. The apical end is usually simply rounded, but may exceptionally exhibit an indication of a terminal papilla, which in F. E. SCHULZE's specimen seems to have been of a general occurrence. In comparison with the figure given by that author of the same spicule, the head appears too of considerably larger dimensions. The pileate dermal clavule (fig. 5) is of much the same appearance as that of *erecta*. It is distinctly shorter than the smooth-clavate variety, generally measuring 275—350 μ long. The pilear disc or cap is subconical, up to nearly 30 μ in diametre, and shows numerous small marginal teeth, apparently somewhat better developed than in the "Challenger" specimen. On the subpilear thickening there exists, as a rule, a second circle of teeth. Rarely the head is of a top-like shape and exhibits only a single circle of teeth around it (fig. 6). By decrease in the number of teeth (fig. 7) and final disappearance of these, the pileate-headed form of clavule passes gradationally over into the smooth-headed form (fig. 8). Special examination of the clavules in a medium of high refractibility brings out the fact, that the axial canal of the shaft terminates with a minute axial cross, situated close to the apex of the head, both pileate and smooth-clavate, demonstrating beyond the reach of doubt the confirmedly monactine nature of the spicules in question. (Cfr. pp. 123 and 124).

Gastral clavules (fig. 4) measure 280—420 μ in length. They are generally anchorate, with 8—4, but mostly 4, anchor hooks. The head measures 23—38 μ from tip to tip of opposite hooks. Seldom it is pileate-like, with a whorl of about 12 teeth.

The oxyhexaster, which occurs very numerously, is 90—135 μ in diametre. Each moderately long principal bears 2 or 3 strongly divergent terminals about as long as, or distinctly shorter than, it. Occasionally the oxyhexaster is hemihexastrous. A second kind of oxyhexaster with short principals, mentioned by F. E. SCHULZE but held by him in doubt as to its belonging to the type specimen, was not discovered. Not infrequently, however, there were met with some tylohexasters quite like those which are found in *F. occa ouwensi* n. subsp., differing in no way from the oxyhexaster except in the terminals being tipped each with a minute knob or discoid cap, instead of running out to a fine point.

The uncinates are of the usual character.

Together with the above described specimen there were obtained at Stat. 226, besides some which were previously referred to *F. occa erecta*, a number of dead and more or less corroded pieces of *Farrea* stocks. Of these the large one, shown in fig. 16, pl. X, may be taken as a good representative. They may possibly represent either *clavigera* or *erecta*, or both, if not certain other Indo-Malayan form of *F. occa*, which scarcely differs from either in the habitus of stock and in the structure of the bare skeleton.

The specimen from Stat. 280, which I identify with *F. occa clavigera*, consists of a piece of stem-tube, 15—17 mm. in diametre at the terminal osculum and bearing some short and alternately opposite lateral branches, some of which again divide into two tubes, one

directed superiorly and the other inferiorly. The external wall surface distinctly shows some low ridge-like prominences, besides well-developed lateral interoscular carinae. The wall is rather thick; it may be 1.5 mm. thick close to the obtuse oscular edge. Thus, the stock may be said to agree well in habitus and general structure with the first described specimen of *clavigera* from Stat. 226, as also with *F. occa erecta* in general. — The spiculation is also essentially the same as in the specimen from Stat. 226. It should however be noted that the pileate dermal clavule is noticeably more common in this than in that specimen, though still remaining decidedly below the smooth-clavate variety in numerical proportion. The latter variety of the clavule has the head ovoid or oblong ovoid in shape and somewhat shorter in length than, though nearly the same in breadth as, in the first specimen. — The oxyhexaster is but very rarely hemihexasterous. No tylohexaster was met with.

Remarks. — *F. occa clavigera* is probably a form very closely related to *F. occa claviformis* H. V. Wils. (1904, p. 57) from the west coast of Mexico. The chief differences between the two consist in the latter forming a clumpy stock of anastomosing tubes as in *F. occa occa*, instead of being slender and erect and bearing short lateral branch-tubes; in the thinner tube-wall supported by dictyonal framework of a single lattice layer; and in the gastral clavule being commonly pileate with 9—6 marginal teeth, instead of anchorate. Further, the spiroanchorate gastral clavule, which should rarely occur in *claviformis*, has never been found in *clavigera*.

The fact that *clavigera* and *erecta* apparently blend together, has already been indicated while describing the specimens referred to the latter. At times I have thought of even the possibility that the pileate and smooth-clavate forms of the clavule are merely vicariating modifications dependent upon certain physiological condition of individuals or of the parts of individuals.

Topsent (1904*a*) has assumed that the smooth-clavate clavule of *F. clavigera* is a simplified sarule, differing from this only in the absence of the spines on the head end, and has accordingly placed that form under F. E. Schulze's genus *Claviscopulia* characterized by having the sarule together with pileate and anchorate clavules. That this view can not be consented to, I have already tried to show on p. 125 of this report.

3. *Farrea occa subclavigera* n. subsp. (Plate XI, figs. 12—21).

Stat. 267. 5° 54′ S., 132° 56′.7 E. 984 m. 1 specimen and fragments.

Diagnosis. — Like *F. occa erecta* in habitus of stock; with tube-wall thick, dense, hard and externally fairly smooth-surfaced. Spiculation as in *F. occa clavigera* or *F. occa mammillata*, but characterized by having the smooth-clavate dermal clavule in an unusual form in which the head swelling tapers very gradually and uniformly on to the inferior shaft end, the entire spicule measuring 600—800 μ in length. Gastral clavules partly pileate and partly anchorate. Dermalia and gastralia with paratangential rays rather prominently tubercled on the outer side. Oxyhexaster frequently hemihexasterous.

Description. — This subspecies is based on a moderately large specimen (pl. XI, fig. 12) and a few fragments which have preserved the soft parts together with loose spicules. They have come from Stat. 267, a spot to the east of the southern part of Great Kei I. The

same haul of the trawl has brought up two specimens of *F. occa cuspidata* n. subsp., besides a large number of either dead or completely water-washed Farreas which, to judge from their habitus, may be either the present subspecies or the other just mentioned. One of the macerated specimens assumed to represent the former is shown in pl. XI, fig. 13.

The type specimen of *F. occa subclavigera* (fig. 12) lacks the basal parts but is otherwise nearly entire. The habitus closely resembles that of *F. occa erecta* or of *F. occa clavigera*. The erect stem-tube, about 93 mm. long, is at the upper end 16—19 mm. and at the lower end about 10 mm. in diametre. The short lateral branches or oscula are alternately situated, arranged not quite in two opposite rows but rather in a slow-winding spiral series. One, or perhaps both, of the two lowest and nearly oppositely standing branches have the oscular opening at the end divided into an upper and a lower one by a bridge-like connection of the lateral walls. The tube wall is in all parts remarkably thick, dense and hard, the thickness varying from 1.5 mm. to nearly 3 mm. and being in most parts about 2 mm. It remains thick close up to the bluntly or acutely edged margin of oscula. Externally the wall is fairly even-surfaced, not raised into ridges, except above each large lateral osculum in which position there exists an interoscular carina of varying length. The entire dermal surface presents a finely porous appearance, while on the gastral surface the rectangular-meshed lattice-like structure of the primary dictyonal framework is more or less distinctly indicated.

Spiculation. — As in most other Indo-Malayan forms of the species collected by the "Siboga", the outer and by far the greater part of the thickness of the dictyonal wall is closely and irregularly meshed alike in all parts of the stock and even right close to the margin of oscula. It is the condition which, in the thinner-walled forms, as, f. i., in *F. occa occa* of Japan, obtains only in the old basal parts of the stock. The dictyonal beams in the wall periphery are smooth and 25—70 μ thick. Only on the gastral surface of the wall the beams are seen, as already said, to form rectangular meshes which are mostly longitudinally elongate and transversely narrow. The meshes may be nearly 1 mm. long and 180 μ wide; the bounding beams are 70—100 μ thick. The regularity of the meshwork is frequently much disturbed by the occurrence of secondarily added beams that take no definite direction in their course. Rough-surfaced, harrow tooth-like spikes project from the dictyonal nodes of the gastral surface. Small dictyonal hexactins, attached to the beams by one or more of their rays, are common at places, but sparse at other places.

The dermal pentactin (pl. XI, fig. 14) has the cruciate paratangentials 185—270 μ long and about 12 μ thick at base; they are sparsely macrotubercled on the outer side, and subterminally rough-surfaced and slightly swollen. The macrotubercles are conical but always rounded at apex. The unpaired proximal ray shows some much smaller tubercles, or is nearly smooth. — The gastral pentactin is quite similar to the dermal.

The dermal clavule is rarely pileate and generally smooth-clavate but in a peculiar way. The pileate clavule (pl. XI, fig. 18) is very much like that of *F. occa clavigera*. Its subconical cap, 23—30 μ in diametre, is indistinctly mammillate at apex and is provided with 12—20 marginal teeth; the thick subpilear swelling is smooth except for an interrupted circle of small tubercles at about the level of the tips of pilear marginal teeth. The smooth-clavate clavule, occurring in great abundance, is only occasionally of a shape like that of same in *F. occa*

clavigera or *F. occa mammillata*, i. e., of the shape (fig. 17) in which the slender shaft (not over 5.75 μ thick in the middle) is swollen into a more or less distinct head of a club-like or spindle-like form (17—21 μ greatest thickness). But by far the greater number of the smooth-clavate dermal clavules are of the following characteristic form (figs. 15, 16), which may not inappropriately be designated anguilliform on account of its resemblance to the eel in outline. The extreme head end is generally mammillate or furnished with a small umbo-like prominence as in the subspecies *mammillata*; thence inferiorly the breadth increases to the most swollen part (17—21 μ broad) of the entire spicule, which part lies only 27 μ or thereabout from the extreme head end. In its configuration this part of the spicule reminds one of the eel's head and snout (fig. 16). Still more inferiorly from the broadest part indicated, the breadth again decreases on to the thin and sharply pointed tail end. The tapering takes place so gradually and uniformly that the limit between the head and the shaft is nowhere indicated, while the spicule keeps up for a great part of its length a thickness (up to nearly 10 μ in the middle of the spicule), which is considerably greater than that of the shaft in the clavule with more or less distinctly marked off head-swelling. The anguilliform clavule in question may measure 600—800 μ in total length, which is much in excess of that reached by the ordinary smooth-clavate clavule (not over 360 μ long in *mammillata* and 567 μ in *clavigera*). Frequently the anguilliform clavule is not quite straight but is gently bent in the thicker half of its length.

The gastral clavule is found in some preparations to be nearly all pileate and in some others to be predominantly anchorate. The pileate form shows 15—8 marginal teeth to the cap; otherwise it is much like the same of the dermal side. The anchorate form (fig. 19) is provided with 8—4 (commonly 4) anchor-hooks. Very rarely the gastral clavule exhibits a smooth-clavate head of an ovoidal shape.

The oxyhexaster occurs numerously. It measures 100—150 μ in diametre. Commonly two or three, seldom four, strongly divergent terminals arise from each principal; they are about as long as, or somewhat shorter than, the latter. Hemioxyhexasterous forms of the above (fig. 20), in which one or more principals are monoterminal, are by no means uncommon. In a few cases, five of the principals were found to be monoterminal, the sixth principal bearing two terminals; and even some cases of hexactinoid oxyhexasters were met with (fig. 21).

The uncinate seems to require no special description.

4. *Farrea occa mammillata* n. subsp. (Plate XI, figs. 22—32).

Stat. 297. 10° 39′ S., 123° 40′ E. 520 m. Fragments.

Diagnosis. — Stock of irregularly branching tubes up to 17 mm. in diametre, with moderately thick wall without rugosity on external surface. Dermalia rough all over on account of the presence of minute tubercles; the cross of paratangential rays often well arched, with or without a small knob in place of the atrophied distal ray. Gastralia like dermalia. Dermal clavule generally smooth-clavate and only occasionally pileate; the former under 360 μ total length and characterized by showing a small rounded protuberance at apex of head. Gastral clavule mostly pileate, gradating over into anchorate ones of much less frequent occurrence.

Description. — This subspecies is based on a number of fragments from Stat. 297,

off the south-western end of Timor. Presumably they represent two different stocks of a large size, one infested by small commensal Anthozoans and the other not. Plate XI, figs. 22 and 23 show the largest fragment from each. From the appearance of the fragment it may be assumed that the stocks they constituted were of an irregularly branching habitus, though in the basal parts the branches may have sprung out in an alternately opposite direction from a stem-tube, somewhat as in *F. occa cuspidata*. The tube diametre ranges from 11 mm. to 17 mm., flaring more or less at oscula. The wall is moderately thick and firm, though very fragile in nature. It is in most places about 1 mm., and at some other places fully 2 mm., thick or even thicker. The dermal surface is fairly even, without the ridge-like rugosity seen in many old specimens of the subspecies *erecta* and *clavigera*. The gastral surface appears pitted by numerous small apertures up to about $^1/_3$ mm. across.

The same haul of the trawl has brought up a dead thick-walled stem-tube with a number of alternately situated lateral oscula. Possibly it is of the same form as the above, but the complete absence of loose spicules makes its exact identification impossible.

Spiculation. — The dictyonal framework of this new subspecies appears much like that of the subspecies *erecta* and *clavigera*, being made up of meshes in many layers. The meshes of the gastral surface are more or less regularly rectangular, generally measuring 250—500 μ in length of sides. The bounding beams are under 62 μ in thickness. In the peripheral parts of the wall the meshes are triangular or rather irregular in shape, probably owing to the accretion of secondarily developed dictyonal hexactins to the primary latticework with rectangular meshes. The beams in those parts are generally under 50 μ thick. The thickly tubercled, vertical spikes of the gastral surfaces are up to 412 μ long; those of the dermal side, up to 300 μ long.

The dermalia (pl. XI, fig. 24) have rays rough all over, on account of the crowded presence of minute tubercles which are frequently somewhat more distinctly developed on the outer side of their paratangential rays than in other parts, though never to a prominent size that would justify calling them macrotubercles. The atrophied distal ray is usually traceless, only occasionally there exist in its place a low swelling at the most. The paratangentials are 185—250 μ long and 11—15 μ thick at base. They are more or less distinctly bent, and that not infrequently to such an extent that the two rays in one axis assume a bow-like curvature. The gastralia are quite like the dermalia in all respects.

The dermal clavule, occurring in great abundance, is predominantly of a peculiar smooth-clavate form in which the head apex appears roundedly mucronate, though not conspicuously, i. e., a very small part of the rounded apex or the umbo appears surrounded by a ring-depression (pl. XI, fig. 25). Such clavule is 288—360 μ long; the head is not more than 13 μ thick in the thickest part. The clavule is therefore very considerably smaller than the corresponding one in the specimens known to me of the subspecies *clavigera*. — By far a smaller proportion of dermal clavules has a pileate head (fig. 27). This sort of clavule is 216—258 μ long, and is therefore again distinctly shorter than the mammillate smooth-clavate form first mentioned. The cap is generally about 18 μ in diameter, it is subconical and has the apex either simply rounded or shows a central umbo-like prominence. The small marginal teeth of the cap number 18—21. The subpilear thickening exhibits some indistinct tubercles, a part of which may sometimes be arranged in a circle around it.

The gastral clavule varies from pileate to anchorate. It is on the whole somewhat shorter than the dermal pileate, measuring 196—220 μ in length. The pileate gastral clavule (fig. 28) is far more abundant than the anchorate. In it the cap is 16—25 μ in diametre, either convex like a watch-glass or more or less subconical and with or without the umbo marked off at apex, and provided with small marginal teeth, 19—10 or thereabout in number. The subpilear thickening shows a few scattered microtubercles. — The anchorate gastral clavule (fig. 29) is relatively rare. The anchor-hooks number 8—4 and may be 15 μ long, the entire anchor measuring 26 μ across from tip to tip of two opposite hooks. The gastral surface may at places show no clavules for a considerable extent of area.

Oxyhexasters of about the usual shape are moderately numerously present. Diametre 75—107 μ; principals 22—40 μ long; terminals 2 or 3, seldom 4 to a principal, generally more or less distinctly shorter than this. Rarely the oxyhexaster occurs in the form of a hemioxyhexaster, or may assume, by entire suppression of one or more principals together with terminals belonging to them, the form of an oxypentaster (fig. 30) or of an oxystauraster (fig. 31) or even of a uniaxial oxydiaster (fig. 32). However, these singular modifications of the oxyhexaster may not be of much practical use in the systematic, requiring as it does too much searching before one can be found. Topsent (1901 *a*), it may be noted, has also observed some hemioxyhexasters among the oxyhexaster of *F. occa* collected by the "Belgica" in the Antarctic.

Among the several oxystaurasters I have met with, there were more than one in which the central node gave rise, on its one side and in place of one of the two atrophied rays, directly to a pair of fine, short and diverging spine-like processes, which irresistibly gave the impression of their being the remnants of terminals after the disappearance of the principal that bore them. I regard it probable that we have here to do with an oxypentaster in the last stage of becoming converted into an oxystauraster. In favour of this interpretation stands the fact that, in some oxypentasters observed, the single unpaired principal was found to be distinctly the shortest of all (fig. 30), while the terminals to all the five principals were about equally developed.

In the several cases of oxydiasters, which came under observation (fig. 32), a remarkable fact was that the spicular centre, represented by a swelling, was situated nearer to one end than to the other, indicating a marked unequalness in the length of the two existent principals in one axis. Another peculiar point I have noticed in this uniaxial and anisoactine oxydiaster, is the fact that, while the longer principal bore the terminals in about the usual number (2—4), the shorter in one and the same spicule was seen to be provided with an increased number of them (4, 5 or even 8).

A description of the uncinates may be dispensed with, as it exhibits no characteristic points of value to the systematic.

Remarks. — The subspecies is obviously very nearly related to both *F. occa clavigera* (F. E. Sch.) and *F. occa claviformis* Wils., so much so that I at first hesitated to separate it from either. From the former, however, it seems distinguishable by all the clavulae being smaller and more slender; by the apex of the smooth-clavate dermal clavule being constantly mammillate instead of being simply rounded; by the more numerous occurrence of pileate gastral clavules with small and somewhat more numerous marginal teeth; by the oxyhexaster having, though

rarely, one, two or four of its principals suppressed together with terminals belonging to them; and perhaps also by the irregularly branching of the stock.

With *F. occa claviformis* Wils. the present subspecies seems to agree, amongst other points, in the general habitus of stock and in having gastral clavules which are predominantly pileate, but may be distinguished from it again by the smooth-clavate dermal clavule being mammillate at apex of head; by the cap of the pileate gastral clavule being more numerously (19—10 teeth instead of 9—6) toothed at margin; by the absence of the peculiar spiro-anchorate gastral clavule; by the oxyhexaster showing a tendency to become reduced in the number of its rays.

5. *Farrea occa cuspidata* n. subsp. (Plate XII, figs. 1—8).

Stat. 145. 0° 54′ S., 128° 39′.9 E. 827 m. 3 specimens besides fragments.
Stat. 156. 0° 29′.2 S., 130° 5′.3 E. 469 m. Several specimens besides fragments.
Stat. 262. 5° 53′.8 S., 132° 48′.8 E. 560 m. 10 specimens besides fragments.
Stat. 266. 5° 56′.5 S., 132° 47′.7 E. 595 m. A few fragments.
Stat. 267. 5° 54′ S., 132° 56′.7 E. 984 m. 2 specimens.

Diagnosis. — Stock erect; stem-tube with alternately opposite, short branches in the basal parts, but repeatedly branching and frequently anastomosing in the upper parts. Tube wall moderately thick. Dictyonal skeleton close-meshed; the beams at places profusely tubercled, at other places sparsely and irregularly tubercled or quite smooth. Dermalia with conspicuous conical macrotubercles on the outer side of paratangential rays. Dermal clavule both pileate and cusped clavate in varying numerical proportion; the latter characterized by having on top of smooth-clavate head a central apical cusp surrounded by four similar but smaller cusps.

Description. — The specimens which I put together under this new subspecies were collected by the "Siboga" in a large number at her Stations 262, 266 and 267 near the southern end of Great Kei Island, and also at Stations 145 and 156 in the Halmaheira Sea (east of Djilolo). If the completely macerated fragments from Stations 159 (N. of Kofiau I., Halmaheira Sea) and 173 (off eastern end of Ceram) are of this subspecies, cannot be definitely determined. At station 267 this subspecies was obtained together with *F. occa subclavigera* n. subsp.

As representative specimens of the subspecies I have selected the two, shown in pl. XII, figs. 1 and 2, from among the lot obtained at Station 262. Summarily speaking, there arise from the irregular basal attachment the stem-tube, which is at first 5—8 mm. thick but may widen superiorly to a diametre of 10—15 mm. In the basal parts it makes a few somewhat zigzag-like bends, bearing on the convex side of each bend a short branch-tube which is thus arranged in an alternately opposite disposition. The branches usually end with two oscular openings, one directed superiorly and the other inferiorly. After giving off in all three or four of such lateral branches, the mode of branching becomes rather irregular, so that the distinction into stem and lateral branches can no longer be carried out. The several branches thus formed in the upper parts of the stock divide in a dichotomous way and frequently anastomose with one another. Like most Indo-Malayan Farreas collected by the "Siboga", the tube wall in all parts of the stock is moderately thick and firm. The thickness may reach quite or nearly 2 mm. in the greater part of a large specimen.

Spiculation. — The dictyonal skeletal wall is irregularly close-meshed, excepting the

innermost layer or two of the meshes which are, as usual, more or less regularly rectangular in shape. The irregular meshes of the periphery are generally 200—250 μ wide; those of rectangular shape in the deeper parts 125—412 μ in the length of sides. The beams vary from 40 μ to 80 μ in thickness. A noteworthy character of them consists in the fact that they are not always smooth, but are at places rough-surfaced in varying degrees, owing to the presence of some small tubercles. Where these occur in abundance, the roughness of surface may be nearly as pronounced as on the free spikes of the skeletal surface; in most other parts of beams the tuberculation is much more sparse and irregularly scattered (pl. XII, figs. 7, 8), varying to such a state of surface as is nearly or quite smooth. The densely tuberculated spikes are well developed on the gastral side of the wall (fig. 8), measuring up to 450 μ in length and being at base nearly as thick as the ordinary beams arising from the same dictyonal node. They are not always straight, but are often bent like the horn. The spikes of dermal side are as a general matter, somewhat shorter and smaller (fig. 7).

The dermalia (figs. 3, 4) have the paratangential rays gently curved, as seen in the lateral view; they are 200—210 μ long, 15—19 μ thick at base, and beset with a number of conspicuous macrotubercles on their outer side, beside being rough subterminally at the obtuse end. The unpaired proximal ray is simply rough all over, due to microtubercles. The macrotubercles on the paratangentials are more numerous than in subsp. *erecta* and *clavigera* or *subclavigera*. They are generally conical with rounded apex, occasionally pointedly conical, and at other times nearly hemispherical. A large macrotubercle may be about 4 μ broad at base and nearly twice as high. — The gastralia are similar to dermalia, with paired rays sometimes reaching up to 280 μ in length.

The dermal clavule is predominantly cusped-clavate and only occasionally pileate. The former kind of clavule (figs. 5, 6) is very peculiar in that the head swelling, which is of about the same general appearance of that of the smooth-clavate clavule, terminates at the top with a small, sharply pointed apical cone or cusp, around which there stand smaller cusps invariably four in number and occupying the position of the corners of a small square. The five cusps are thus quincuncially situated on the rounded top of head. They manifestly have nothing to do with the five atrophied rays of the monactine clavule. As shown in fig. 6, pl. XII, the small axial cross of the spicule lies slightly below the level of the four smaller cusps en quadrille, without any of the five vestigial axial canals reaching up to even the cusp bases. I regard the cusps to be nothing more than mere prominences, as are the spines on the head of the sarule. They may all be so distinct as to readily attract one's attention, but may sometimes be so inconspicuously small, as to require a high power of the microscope to be distinctly observed. In rare instances they may be factually quite obsolete or even entirely suppressed, giving either a simply rounded or a somewhat mammillate-like appearance to the top of head, as in subsp. *clavigera* or *mammillata*. The clavules in question measure 430—464 μ in total length. The head, usually of a rather slender club-like shape, generally measures 12—15 μ thick in the thickest part. Exceptionally it approaches the ovoidal in shape, reaching up to 20 μ in greatest thickness; and it is usually in such cases that the cusps may be undeveloped. The shaft is about 4 μ thick in the middle of the entire spicule. — The pileate dermal clavule, of much less frequent occurrence, has the head shaped and characterized like that of the same spicule in subsp. *clavigera*

(pl. XI, figs. 5, 6) or subsp. *subclavigera* (pl. XI, fig. 18). Total length 285—330 μ; the subconical cap 23—25 μ in diametre, with 20 or a less number of small marginal teeth.

The gastral clavule is isolated but rather commonly present. The head is anchorate and of the usual shape with 4 anchor-hooks. The shaft is fine. Total length up to 280 μ; about 35 μ across from tip to tip of opposite anchor-hooks.

The oxyhexaster is common but not abundant. It is relatively small, measuring usually 73—85 μ, but sometimes as much as 92 μ, in diametre. There are two or three terminals to each principal, the former being about as long as, or somewhat shorter than, the latter. Very rarely a principal or two in the same oxyhexaster were found to be monoterminal (hemioxyhexaster). Oxyhexaster with a reduced number of principals together with terminals were not observed.

The uncinate is of the usual character and seems to require no special description.

As to the specimens from stations other than Stat. 262, I may restrict myself to making the following notes.

The few small fragments from Stat. 266 show spiculation which may be said to tally nearly completely with that described above.

The two specimens from Stat. 267 possess pileate dermal clavules in a relatively numerous proportion, being met with in certain preparations even more commonly than the cusped-clavate form. As might be anticipated, the numerical proportion of the two clavule forms seems to be a matter which is subject to a considerable individual variation. The gastral anchorate clavule is not infrequently in possession of more than four anchor-hooks. It passes over gradationally into the pileate form with 14 or 15 marginal teeth to the cap. The oxyhexaster measures mostly under 85 μ in diametre. It occasionally occurs in the form of the tylohexaster (under 60 μ diametre) agreeing in characters with the same of *F. occa ouwensi* n. subsp.

A specimen of the subspecies examined from Stat. 145 was remarkable for the unusually strong development of the conical or subconical macrotubercles on the paratangential rays of dermalia, reaching not uncommonly 13 μ in height and 8 μ in breadth at base. Macrotubercles were also present in a few number on the basal half of the unpaired ray, similarly as in the *F. occa* obtained by the "Albatross" near the Guadeloupes and reported on by F. E. Schulze (1899*a*). Characteristic cusped-clavate clavules were observed in some number. Oxyhexasters were under 100 μ in diametre. Amongst them were again met with some in the tylohexaster form, though very rarely.

The specimens from Stat. 156 are noteworthy in that nearly all the dictyonal skeletal beams, beside being unusually strongly developed (in many places as thick as 100 μ), are beset with numerous small tubercles on surface. The tuberculation is most profuse and nearly uniform on the thicker beams of the wall periphery, so that the parts present an appearance not unlike that of the dictyonal reticulum of certain Euretids. Cusped-clavate clavules present.

Finally, from Stations 159 (N. of Kofiau I., Halmaheira Sea) and 173 (off eastern end of Ceram) there are some small, completely washed-out fragments, which agree with the present subspecies in the character of the dictyonal skeleton, but particularly in the tuberculation of the beams. However, in the total absence of loose spicules, a definite identification of the fragments cannot be done, and that all the more since *F. occa ouwensi* n. subsp. may sometimes have the dictyonal skeleton similarly tubercled as that of the present subspecies.

6. *Farrea occa ouwensi* n. subsp. (Plate XII, figs. 9—21).

Stat. 119. 1°33′.5 N., 124°41′.0 E. 1901 m. 1 specimen and fragments.
Stat. 122. 1°58′.5 N., 125° 0′.5 E. 1264—1165 m. 1 specimen.
Stat. 124. 2°27′.0 N., 125°35′.0 E. 1327 m. 1 specimen and fragments.
Stat. 226. 5°26′.7 S., 127°36′.5 E. 1595 m. 4 specimens.
Stat. 251. 5°28′.4 S., 132° 0′.2 E. 204 m. 1 specimen.

Diagnosis. — Stock erect or clumpy. Tube wall not thick. Dictyonal beams smooth, or may be tubercled, especially those secondarily added to outside of primary rectangular-meshed latticework. Dermalia with rays either faintly rough or weakly spiny. Gastralia with same, sparsely macrospiny or coarsely rough. Dermal clavule pileate, with flatly subconical cap. Gastral clavule anchorate with 4 or more anchorhooks, or pileate with 6 or more marginal teeth. Hexasters all tylohexaster, or both tylohexaster and oxyhexaster. The tylohexaster 46—80 μ, rarely 107 μ, in diametre; with usually 2 or 3, widely divergent and nearly straight terminals to each principal, which is about as long as, or somewhat longer than, the former; terminal knob minute, sometimes obsolete. The oxyhexaster shaped essentially like the tylohexaster.

Description. — The specimens from the different stations will be designated A, B, C, D, and E, in the order of the above list of the stations.

Specimen A, from Stat. 122 (off the northern end of Celebes), incomplete though it is, may serve as the type of the subspecies (pl. XII, fig. 9, 11—13). It is a short tube thrice bent in a zigzag way and broken off at both its ends. Each bend of the tube bears on the convex side a short branch with osculum (fig. 9). Diametre of the tube 7 mm. at one end and about 10 mm. near the other, presumably the upper, end. The wall is not more than 1 mm. thick in the thickest parts. It is supported by a 1—2-layered dictyonal latticework with rectangular meshes, to which latticework are added, on the external side, secondary beams that run in indefinite directions and bring about an ill-defined peripheral layer of irregular-meshed dictyonal reticulum. The rectangular meshes may be about 500 μ long, and the beams, bounding them, 145 μ thick. Beams in the wall periphery are generally 30—65 μ thick. In no part of the wall occurs a tuberculation on beam surface, except on the spikes which project as usual on both the dermal and gastral sides. Small oxypentactins occur, attached to the beams in the usual manner.

The dermal pentactin has slender rays 200—300 μ long, about 12 μ thick at base, faintly rough-surfaced all over, due to weakly developed microtubercles, and roughest at the end which is often slightly swollen. A low rounded protuberance is present in place of the atrophied distal ray. — The gastral pentactin has rays up to 350 μ long, sparsely macrospiny, and rough-surfaced at end. The macrospines, which are of a conical shape, are small but distinct.

Dermal clavules are all pileate (pl. XII, fig. 11), length 270—310 μ. The cap is flatly subconical or nearly watchglass-like and 30—35 μ in diametre; marginal teeth 22—25 in number; subpilear thickening with a circle of lowly conical tubercles, situated a short distance from the cap and giving to the thickening an appearance of being angulated there in a ring. For a short distance below that circle of tubercles, the narrowing transitional part of the head into the shaft is roughened by the presence of some small tubercles. For the rest the slender shaft is nearly smooth. — Gastral clavules are anchorate with 9—6 anchor-hooks. They occur but sparsely.

The hexaster is present in abundance. It is represented by tylohexasters only (figs. 12, 13).

I have repeatedly searched in vain for the oxyhexaster. The tylohexaster measures 55—107 μ, but mostly above 84 μ, in diametre. The terminal swellings are minute and somewhat flattened but without marginal teeth. The rays, both principal and terminal, are slender. The principals, only about 2 μ thick at base, bear each 2 or 3, occasionally 4, divergent terminals. These are nearly straight or perceptibly bent, and sometimes about as long as, but more frequently distinctly shorter than, the principals bearing them. In the latter case, the terminals may be about $^1/_2$ or even nearly $^1/_3$ the length of the principal. The smaller of the tylohexasters may appear quite like fig. 17 or fig. 18, pl. XII.

The uncinate is of about the usual shape and dimensions.

In the same bottle as that which contained the above described specimen of *F. occa ouwensi* was found a dead and macerated piece of a thin-walled and branching *Farrea* tube which cannot be exactly identified. It may possibly be of the subspecies just mentioned, or an immature *F. occa erecta* of which some specimens (E, F) were also obtained at the same station.

From Stat. 119 (off to the west of Menado, northern Celebes) there is the pretty specimen (B) shown in pl. XII, fig. 10, besides several small fragments. It is a fair-sized clump, about 45 mm. high, of thinwalled, branching and anastomosing tubes. In the parts which I take for the original base of the stock, the tube is not wider than 3 mm., while at places in other parts it is nearly 10 mm. wide. In its habitus and general appearance the stock is scarcely distinguishable from *F. occa occa* of a similar size. The tube wall, in by far the greater part of the stock, is made up of a single-layered dictyonal latticework with rectangular meshes and with the usual internal and external spikes, as well as microhexactins numerously attached to the beams. The rectangular, though round-cornered, meshes measure generally 200—350 μ in the length of sides; the beams up to 100 μ in thickness. Irregular reticular beams, secondarily added to the outside of the primary skeletal framework, are densely present in the basal parts, which, on that account, present a compact structure; but in other parts of the stock they are found only here and there in a very thin layer (fig. 14). Noteworthy is the tuberculation of the beams. On the primary beams the tubercles are rather sparse and irregularly distributed; while on the secondary beams in the wall periphery, wherever these occur, the tuberculation is much more profuse and uniform, as will be seen from fig. 14, pl. XII. The thickly tubercled external spikes found in parts of such characterization may be, as they often are, of a thick knob-like form, without doubt owing to secondary addition of siliceous matter on their surface.

The specimen in question is nearly completely water-washed, but has fortunately retained in certain parts traces of the soft tissue together with some loose spicules. Examination of these has placed beyond doubt the identity of the specimen with some of the well-preserved fragments found in the same bottle. As determined from these fragments, the more important points regarding the loose spicules are as follows: — The small tubercles on the paired rays of dermal pentactins are somewhat more prominently developed than in the type (specimen A) from Stat. 122; they nearly deserve to be called macrospines, though as such they must be said to be weakly developed. — The pileate dermal clavule (fig. 15) is provided with a watchglass-like cap showing an indication of the apex and possessing marginal teeth up to about 20 in number; the sparsely tuberculate subpilear swelling is much narrower than in the

type specimen and exhibits a narrow, distinctly constricted annular zone, immediately below the cap. The gastral clavule is, like the dermal, pileate but with 13—6 marginal teeth. Anchorate gastral clavules were not observed. — The hexaster is both tylohexaster and oxyhexaster, the two kinds being on the whole almost equally common, though in different parts of the stock either of them may occur in greater or less excess over the other. The tylohexaster, commonly 46—77 μ in diametre, compares well with that of the type specimen as well as with that of specimen C from Stat. 124 (figs. 17—19). The oxyhexaster, commonly 65—107 μ in diametre, is of the usual appearance, the terminals being about as long as, but sometimes either somewhat longer or shorter than, the principal they belong to.

Specimen C was obtained at Stat. 124, a spot off the northern extremity of Celebes and not far distant from the two localities whence came the two specimens already described above. In habitus of stock and in the appearance of the wall, it closely resembles the type of *F. occa erecta* shown in pl. X, fig. 1. Unlike specimen B or specimen E of the present subspecies, it is an erect tube bearing five lateral oscula or very short branches arranged, not strictly in an alternate-opposite disposition, but with at least one branch directed away from the plane of the others. Height of stem-tube 70 mm.; its diametre close above basal expansion 6—7 mm.; diametre at the upper end 11 mm. The wall is firm, though at the most only about 1 mm. thick in the greater part of the stock. It is translucent in the wet state, indistinctly revealing the lattice-like dictyonal structure. The surface is slightly uneven in the upper parts. A low carina exists above each of the three uppermost branches.

The primary dictyonal latticework is in all parts externally covered over by a thin, irregular-meshed dictyonal layer of secondary formation. Rectangular meshes of the former measure generally 400—750 μ in the length of sides, and the beams up to nearly 80 μ in thickness. Tuberculation occurs only quite sporadically, except on both external and internal spikes which are densely tubercled as usual. Dermal pentactin faintly rough as in the type specimen; its paired rays 200—250 μ long, rather slender. — Gastral pentactin with paired rays sparsely macrospiny. — Dermal clavule (fig. 16) pileate, closely similar to same of the type. — Gastral clavule anchorate, with 4 anchor-hooks. — Hexaster is again both the tylohexaster and the oxyhexaster, occurring in varying numerical proportion in different parts, though on the whole the latter seems to be the more numerous. The oxyhexaster is of the usual appearance, measuring 80—100 μ in diametre; it is occasionally hemihexastrous (fig. 21). The tylohexaster (figs. 17—19) is generally 57—80 μ, sometimes 107 μ, in diametre and similar in appearance to the same of specimens A and B; it may also occasionally be hemihexastrous. The minute terminal swelling is simply knob-like or somewhat flattened like a disc. In some cases the terminals were observed to end simply rounded, without showing a swelling or running out to an acute point. Further, a few instances of oxy-tylohexasters (fig. 20), i. e., hexasters of the usual general shape but with terminals, in part minutely knobbed and in part finely pointed, came under observation. This plainly indicates that the difference between the oxyhexaster and the tylohexaster is one of a comparatively trivial nature.

Specimen D, from Stat. 226 (Banda Sea), consists of four small and apparently young individuals not more than 20 mm. high and 4 mm. thick above basal expansion. They were

trawled up together with *F. occa erecta*. All are more or less macerated. The occasional presence of the tylohexaster, together with the oxyhexaster, has induced me to identify them with the present subspecies. Dictyonal beams, especially those of the wall periphery, are tubercled in varying degrees.

Specimen E, from Stat. 251 (S. of Kur Is.), is an irregular clumpy stock not more than 40 mm. high and consisting of anastomosing tubes, 4—8 mm. in diametre of oscular ends. The habitus is very much like that of the specimen B from Stat. 119; but the wall, which is firm and 0.5—0.75 mm. thick, is of a more uniformly compact appearance, due to the secondary dictyonal reticulum covering the primary latticework all over. The spiculation agrees nearly completely with that of the specimen just referred to; but for the sake of certainty let the following be noted. Rectangular meshes of the primary dictyonal latticework rather small, rounded at corners; peripheral dictyonal beams with tubercles at places irregularly scattered, but at other places closely and uniformly distributed; dermalia weakly rough; gastralia more coarsely rough; dermal clavule showing subpilear constriction; gastral clavule pileate like dermal; both oxyhexaster and tylohexaster common.

A second small specimen closely resembling the above was obtained at the same station, but does not admit of an exact identification owing to the complete absence of free spicules.

Remarks. — *F. occa ouwensi* appears to be a form most closely allied to *F. occa occa*. This is indicated by the wide-going similarity in the habitus of stock, in the relatively thin development of tube wall and dictyonal skeleton, and also in spiculation, but excepting the fact that in *ouwensi* the hexasters are entirely, or at least very largely, tylohexasters instead of being all or predominantly oxyhexasters. The tylohexaster and the oxyhexaster, irrespective of the latter's belonging to *ouwensi* or to typical *occa*, are essentially alike in appearance and proportions of parts, save in the manner of the ending of terminals. Similar tylohexasters are known to me to occur, though quite sporadically and isolatedly, in certain individuals of *F. occa* from Japan which are indistinguishable from *F. occa occa* in all other points. After all, then, the essential difference between *F. occa ouwensi* and *F. occa occa* appears to be one of degree only, chiefly consisting in this that, while in the former the tylohexaster is of a constant occurrence and may occur either exclusively alone or in a large number together with the oxyhexaster, in the latter the same is entirely replaced by the oxyhexaster or may at the most be very sparsely represented among the oxyhexasters present. In other words, the two forms of the species seem to grade over into each other without a sharp demarcation.

The above new subspecies or variety of *F. occa* I have named for Major P. A. Ouwens of the Zoological Museum in Buitenzorg, Java.

7. *Farrea hanitschi* n. sp. (Plate XIII, figs. 1—9. Textfig. 22).

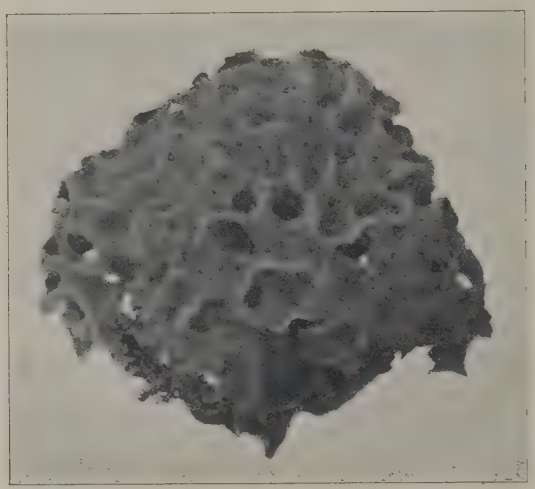
Timor Sea. 10° 47′ S., 127° 15′ E. 82 m. 1 specimen.

Diagnosis. — Stock clumpy, consisting of thin-walled anastomosing tubes about as wide as the interspaces between them. Dictyonal latticework in most parts single-layered, the beams with tubercles in irregular distribution. Both dermalia and gastralia with paratangential

rays macrospiny on outer and lateral sides. Clavules of both sides pileate, with cap arched like a watchglass; occasionally anchorate. Oxyhexaster with unusually shortened principals, not exeeding 12 μ in length and with relatively long terminals. Tylohexaster quite like the oxyhexaster in general appearance, on the whole somewhat smaller and much less common in occurrence than same.

Description. — This new species is based on a single dried but beautifully preserved specimen (textfig. 22) which was obtained, not by the "Siboga", but by Mr. Maclear Ladds, who found it attached to a submarine cable reclaimed at a spot in Timor Sea, about midway between Timor and Australia. It was kindly given me for study and description by Dr. Hanitsch of the Raffles Museum in Singapore, in honour of whom I have named the species. The description is incorporated in this report on account of the proximity of the locality to the seas which were covered by the "Siboga" expedition.

The stock, which seems to have been attached to the cable by irregular basal surfaces, is of a clump-like shape, measuring 55—73 mm. in diametre. It consists of closely branching and anastomosing tubes, 6—8 mm. wide in most places and opening on the stock surface by means of oscula of a roundish, oval, lobate or sinuous configuration. The wall is thin and very delicate in nearly all parts of the stock. The intercanal-like spaces between the tubes are about as wide as these, and it is often difficult to distinguish between the two at a glance. In its general appearance the sponge very closely resembles *Aulocystis zitteli sibogae* n. subsp. which was obtained at the same time and spot by the same collector; so that, the original assorter had naturally thrown together the two in the same lot. However, after a little observation without taking recourse to the microscope, it was found easy to distinguish one from the other, especially by the fact that the *Aulocystis* wall, besides being slightly thicker, is peculiarly liable, when subjected to a breaking strain, to fracture in lines parallel to the oscular margin, which propensity is not observed in *Farrea*.



Textfig. 22. — The type specimen of *Farrea hanitschi* n. sp., preserved in the Science College, Tokyo Imperial University. Natural size.

Spiculation. — The dictyonal skeleton is made up, nearly throughout the stock, of the usual rectangular-meshed latticework in a single layer (pl. XIII, fig. 1), which fact stands in relation to the delicate nature of the sponge. Only sporadically on the wall there occur areas of a limited extent in which the primary latticework has received a secondary addition of some thinner beams, whereby the original regularity of the meshes is more or less disturbed. The rectangular meshes in most parts of the sponge measure usually 150—300 μ in the length of sides; the beams are generally 32—57 μ, on an average 40 μ, thick. The beams exhibit more or less tuberculation on surface. The tubercles are either conical or rounded and low; they are very irregularly distributed, being quite sparse on some beams, but so numerous on others as to render the surface decidedly rough. Towards the oscular margin the beams grow gradually

thinner (down to only 7 μ or less thick), becoming at the same time quite or nearly quite smooth on surface. In the basal parts the beams are stronger and the meshes narrower than in any other parts. There the beams frequently reach 60 μ in thickness and again show smooth surface, the tuberculation having presumably disappeared as the accretion of siliceous matter advanced. The harrow-tooth-like spikes on both sides of the dictyonal latticework are as usual thickly tubercled and are generally 160—270 μ long. — Small dictyonal hexactins, so commonly found attached to dictyonal beams in other Farreids, were not met with. They must be rare, if present at all.

The dermal pentactin (pl. XIII, figs. 2, 3) has rays gradually tapering to the obtusely pointed end. A prominent knob of a conical or rounded shape exists in place of the atrophied proximal ray. The paratangential rays measure 150—215 μ long and 7—12 μ thick at base; they are nearly straight or very weakly bent, and are provided on the outer and lateral sides with some erect spines or conical macrotubercles. The unpaired proximal ray is about as long as, or slightly longer than, the paratangentials, and shows inconspicuous microtubercles in a sparse distribution. — The gastral pentactin is quite like the dermal.

The dermal clavule (fig. 7), occurring in abundance, is pileate. Length 210—250 μ; cap of head flatly watchglass-like, 12—19 μ in diametre, with 18—13 marginal teeth; subpilear thickening passing gradually over into the thin shaft, both with some insignificant microtubercles at varying intervals. — The gastral clavule, also abundantly present, is quite like the dermal. Some anchorate clavules (fig. 9) of a relatively large size were met with in the preparations. Presumably they belonged to the gastral side. Length 300—363 μ; anchor-hooks 4 or 5 in number and about 45 μ from tip to tip of two opposite hooks.

The hexaster is partly oxyhexaster and partly tylohexaster. Both are of a similar appearance, and are characterized by the principals being relatively very short in proportion to the length of terminals. The oxyhexaster is by far the commoner, occurring in all parts of the sponge. The tylohexaster is nearly, but not quite entirely, confined in its occurrence to the oscular margin, i. e., the younger parts of the tubes.

The oxyhexaster (fig. 4) measures 80—100 μ in diametre. The unusually short principals do not exceed 12 μ in length. Each of them bears 2, less frequently 3, long terminals which are nearly straight and moderately strongly divergent. The pronounced shortness of the principals seems to constitute the most prominent character of the species, there being known no other *Farrea* species in which the oxyhexaster has so much shortened principals, although the well-developed discohexaster of *F. sollasi* F. E. Sch. and *F. weltneri* Tops. is known to have very short principals.

The tylohexaster (fig. 5, 6) is quite like the oxyhexaster in general shape and in the proportion of parts, though on the whole somewhat smaller. The diametre is 53—83 μ. The terminal swellings are small and without marginal dentation. Frequently they are so minute that they might easily be overlooked, and the spicule taken for an oxyhexaster, unless a high power of the microscope be used for observation. Such cases give one an impression, that the distinction between the two hexaster kinds may be almost be neglected from the systematic point of view. Possibly it may turn out that certain individuals of the species are found to be in possession of the oxyhexaster only, in exclusion of the tylohexaster, or vice versa.

Uncinates of a slender shape are common, being especially abundant in the region of oscular margin. They vary in size from very small ones of 0.5 mm. length to those nearly 2 mm. long and 13 mm. thick. It seemed to me that the barbs were rather strongly developed and stood out somewhat more divergently from the shaft surface than usual (fig. 8).

Remarks. — This new species approaches certain specimens of *F. occa ouwensi* in having both the oxyhexaster and the tylohexaster, but differs from that form, as from any other form of the *occa* series, by those hexasters having relatively very much shorter principals and so presenting a markedly different general appearance. Moreover, *F. hanitschi* has dermalia with paratangentials which are prominently macrospiny, instead of being faintly rough or weakly spiny as in *F. occa ouwensi*.

A still another *Farrea* species which is known to have both the oxyhexaster and the tylohexaster is *F. vosmaeri* F. E. Sch., but here again both the hexasters have prolonged principals and relatively short terminals and are of quite a different appearance from the same of *F. hanitschi*.

8. *Farrea nodulosa* n. sp. (Plate XII, figs. 22—30).

Stat. 90. 1° 17′.5 N., 118° 53′ E. 281 m. 1 fragment.
Stat. 95. 5° 43′.5 N., 119° 40′ E. 522 m. 1 fragment.
Stat. 105. 6° 8′ N., 121° 19′ E. 275 m. A few fragments.

Diagnosis. — Stock of thin-walled, moderately wide and branching tubes. Dictyonal latticework single-layered, with external and internal tuberculate spikes, made up each of a swellen globose or boss-like basal part and of a comparatively slender terminal part. Dermalia and gastralia with slender rays, the paratangentials sparsely macrospiny on outer and lateral sides. Dermal clavule small, pileate with watchglass-like cap. Gastral clavule anchorate; sometimes with a spur-like spine on shaft, a short distance above anchor. Oxyhexaster of the usual form very numerous, occasionally hemihexasterous.

Description. — From Sulu Archipelago (Stat. 95, near Pearl Bank; Stat. 105, north of Jolo I.) and the eastern coast of Borneo (Stat. 90) came the specimens, on the strength of which I have established this new species.

Unfortunately all the specimens are fragments. They represent tubular pieces broken off from stocks, of which the habitus cannot be told any more than that they consisted of thin-walled branching tubes, 4—9 mm. in diametre. The specimen from Stat. 95, shown in pl. XII, fig. 22, is the largest and the most complete in that it has preserved the loose spicules which in all the other specimens has been entirely lost.

The wall is flexible and delicate to about the same degree as in *F. occa occa*, like which it distinctly shows the trellis-like dictyonal skeleton when viewed against the light. In a large part of the wall it consists of a single-layered latticework with quadrate or rectangular meshes, generally measuring 250—450 μ in the length of sides. The beams are smooth-surfaced and may be 40—72 μ thick. At certain places of the specimen, especially in the older parts, the dictyonal latticework is 2- or 3-layered, but is nowhere, so far as the fragmentary specimens on hand go, so thick nor rigid as in most specimens belonging to subspecies of *F. occa* described in this report.

The external and internal spikes are very peculiarly developed and afford the most important diagnostic character of the present species. Instead of being as usual simply spine-like or elongate-conical in shape, the spike is differentiated into a greatly thickened globular or boss-like base and a short, relatively slender, terminal process (pl. XII, fig. 30). The former which may also be regarded as a peculiar excessive swelling of the spike bearing node, is about as thick as, or somewhat thicker (70—90 μ) than, the adjoining dictyonal beams and is coarsely tuberculated on surface. The latter, more densely beset with smaller tubercles, stands out erect and rather abruptly marked off from the top of the basal boss. It measures up to 100 μ in length and is usually about as long as the boss which gives rise to it; its thickness may be 8—15 μ in the middle. The tip is conically pointed, otherwise obtusely so or somewhat rounded. In some cases the extreme tip was found to be nearly smooth. On account of its slimness, the terminal process readily breaks off from the basal boss on rough handling. The macerated specimens from Stations 90 and 105 agree completely with the above description of the dictyonal skeleton

The dermal pentactin (figs. 23, 24) has slender rays tapering to the obtusely pointed tip. A central conical protuberance marks the position of the atrophied distal ray. The paratangential rays, 175—310 μ long and up to about 12 μ thick at base, are very slightly curved inwards and show some conical macrospines (up to 30 μ high), developed on the outer and lateral sides, and rarely on the inner side too. The proximal ray is distinctly shorter than paratangentials of the same spicule; it is sparsely and obsoletely tubercled, not macrospiny. — The gastral pentactin is similar to the dermal, though on the whole slightly larger. Paratangentials 220—330 μ long; the unpaired ray 195—247 μ long; thickness of rays up to 15 μ at base.

The dermal clavule (fig. 27) is sparsely present. It is small, measuring 206—210 μ or more in length. The head is pileate, with the cap watchglass-like, 17—20 μ in diametre, and provided with marginal teeth, numbering 17 in the few cases I could count them. Subpilear thickening elongate, microtubercled, and passing below gradually into the shaft of about 3 μ thickness. — The gastral clavule (figs. 28, 29) is common, anchorate, 200—250 μ long. Anchor-hooks generally 4, rarely more and up to 8 in number, 19—30 μ long; breadth of anchor from tip to tip of opposite hooks 34—53 μ. Shaft smooth and very slender (about 2 μ thick) in that half of the length which adjoins the anchor; slightly swellen in the other half up to about 4 μ thickness and obsoletely microtubercled (fig. 28). Sometimes, but not always, the shaft is armed with a solitary and unilateral spur-like spine at a short distance (30 μ) from the anchorate end (fig. 29). The spine may be 12 μ long.

The hexaster is represented by oxyhexasters only (fig. 26). These occur in great abundance and appear very much like the same of *F. occa*, except in being somewhat larger on the whole. They measure generally 85—138, but mostly about 100 μ, in diametre, the principals being rather slender and 28—46 μ, most frequently about 38 μ, long. Unusually small oxyhexasters of 64 μ diametre and 15 μ in the length of principals occur occasionally near the gastral surface. The terminals number generally 3 or 4, sometimes 5 and rarely 2, to a principal. They are about as long as the principals they belong to, or are somewhat shorter. Occasionally, one or two of the six principals are monoterminal and form, together with the terminal, a straight simple ray, thus transforming the hexaster into a hemioxyhexaster.

The uncinate has not come under observation. But this is certainly not to be considered as implying its total absence in the entire individual or in the species.

At Stat. 159 (north of Kofiau I., Halmaheira Sea) were obtained, in one haul of the trawl, a number of completely washed-out *Farrea* fragments. Most of these I assume to be referable to either *F. occa cuspidata* or *F. occa ouwensi*. Among the rest there is a small branching specimen of 7—9 mm. tube diametre which may best be mentioned in connection with the present species, though the propriety of identifying it with that species may be questioned. Macroscopically the specimen is scarcely distinguishable from the macerated examples of *F. nodulosa*, but the dictyonal wall, which is thicker and quite firm, instead of being elastic, contains more than one rather irregularshaped meshes in superposition in its thickness. The superficial dictyonal nodes of both sides of the wall are each swellen on the outer side into a low rounded prominence, which is beset on the surface with flatly conical tubercles and which bears on the summit a short, slender and rough-surfaced process. Sometimes more than one of such processes are borne on a prominence. The basal prominences are not so distinctly boss-like as in the type of *F. nodulosa*, but are decidedly more depressed. Other dictyonal nodes, situated below the wall surfaces do not show anything like the above characterization. In the absence of observations on the loose spicules, the specimen in question must remain without receiving a definite identification.

Remarks. — *F. nodulosa* may be regarded to be most nearly related to *F. occa occa* or *F. occa erecta*. However, it differs from both very markedly in the peculiar development of the free spikes, which appear to consist each of a swellen boss-like base and slender terminal process. There is known no other *Farrea* species in which the skeleton is similarly characterized, though a similar development of the spike or of superficial dictyonal nodes are found in the different forms of *Pararete farreopsis* (Cart.) described elsewhere in this report.

9. *Farrea spirifera* n. sp. (Plate XIII, figs. 10—15).

Stat. 266. 5° 56′.5 S., 132° 47′.7 E. 595 m. Fragments.
Stat. 267. 5° 54′ S., 132° 56′.7 E. 984 m. 2 specimens.

Diagnosis. — Stock consisting of anastomosing tubes which may reach 9 mm. in diametre. Wall rather thin, supported by one- or two-layered, rectangular-meshed dictyonal latticework with occasional addition of beams running in indefinite directions. Dermalia with weakly rough rays; the paratangentials slightly arched. Gastralia similar to dermalia, though microtubercles on surface may be somewhat more pronounced. Clavules, both dermal and gastral, of two kinds: pileate and spiro-anchorate. The former with watchglass-like marginally toothed cap on head; the latter much shorter, not over 126 μ long, with 4 prolonged anchor-hooks spirally wound around the shaft as axis and forming a twisted bundle longer than $^1/_8$ the entire length of the spicule; the shaft without branch-like spines. Oxyhexaster of the usual form, 134—200 μ (or even 248 μ) in diametre.

Description. — The species is based on two specimens, A and B, which were obtained by the "Siboga" at her Stat. 267 (near southern end of Great Kei I.), together with *F. occa cuspidata* n. subsp. and *F. lendenfeldi* n. sp. Specimen A, shown in pl. XIII, fig. 10, is a small stock of an irregular shape, consisting of anastomosing tubes which in the basal parts

measure 5 mm. and in the upper parts 9 mm. in diametre. Specimen B is a still smaller and apparently a much younger stock, in which the branches have not yet undergone anastomosing junctions. The erect stem-tube is 45 mm. high, the diametre being 4 mm. at the basal and 8 mm. at the upper part. It sends out a number of short branch-tubes, apparently without a definite rule as to their direction or the position of their origin. The tube wall in both the specimens is rather thin and easily breakable, being in most parts only $^1/_8$—$^3/_4$ mm. thick.

Spiculation. — The dictyonal skeleton consists of rectangular-meshed latticework in one or two layers, to which are added, here and there, but chiefly on the external side, some beams which take indefinite directions and tend to disturb the checker-like regularity of the original latticework. The rectangular meshes vary considerably in their dimensions, the length running up to 360 μ. The beams may reach 80 μ in thickness; they are generally smooth, but those in the peripheral situation may at places show microtuberculation to some degree. External and internal spikes with thickly tuberculated surface occur in the usual way.

The dermal pentactin has the cruciate paratangential rays slightly arched, weakly rough on surface, 115—175 μ long and not thicker than 9 μ at base. A central swelling in place of the atrophied distal ray is sometimes present, but not always. — The gastral pentactin is similar to the dermal, except in the rays being on the whole somewhat longer (150—220 μ) and in the microtubercles of the surface being frequently slightly more prominent. In specimen B, some — not all — of the gastralia were observed to have a few conical macrotubercles on the paratangential rays.

The clavule, both dermal and gastral, is of two kinds: the pileate and the spiro-anchorate. The pileate clavule (pl. XIII, fig. 12), common on both sides of the wall, is 206—258 μ long. The shaft is slender; the cap of head convex like a watchglass, 20—27 μ in diametre, and provided with 11—23 marginal teeth. Pileate clavules of the two sides do not differ, except perhaps in the fact that, while in those of the dermal side the marginal teeth of cap frequently reach 21 or 23 in number, the same in those of the gastral side generally do not exceed 16 or 17.

The spiro-anchorate clavule (figs. 13—15) is much shorter, not exceeding 126 μ in length. Its head consists of four prolonged and reverted anchor-hooks which are spirally wound around the shaft as axis, in the same manner as in the similar clavule known from *F. convolvulus* F. E. Sch. and *F. occa claviformis* Wils. The spine-like or branch-like processes which exist on the shaft in the two forms, just mentioned, are here entirely wanting. The spiral winding of the anchor takes place either dextrally or sinistrally. The loosely twisted bundle-like structure thus formed by the anchor-hooks is not longer than $^1/_3$ the length of the entire spicule. It is 30—35 μ broad at the free ends of the hooks. These are obtusely — not sharply — pointed at the tip. The shaft tapers gradually towards the sharply pointed tail end. — In specimen A the above spiro-anchorate clavule is not uncommon on the gastral side of the wall, while on the dermal side it was met with but quite rarely. In specimen B, the gastral side of the wall was found to be altogether very poor in clavules, and not a single example of the spiro-clavate kind could there be discovered; whereas, on the dermal side, this was met with on several occasions. The dermal spiro-clavate clavule of that specimen (figs. 14, 15) were found to be considerably thicker in both the spiral hooks and the shaft than that (fig. 13) of specimen A, and moreover to be minutely rough all over instead of being nearly or quite smooth as in the latter.

In certain preparations some clavules with smooth-clavate head were observed in isolated occurrence but under circumstances which did not exclude the possibility of their being foreign intrusions. The head was either rather slender and cusped at end, quite as in *F. occa cuspidata*, or somewhat pear-shaped as in *F. lendenfeldi*. Remembering that both the Farreas, just referred to, were obtained together with the specimens now being described of *F. spirifera*, the source of the above clavules may be said to be almost clear.

The oxyhexaster (fig. 11), which is present in moderate abundance, is of the usual type but attains an unusually large size. The diameter ranges from 134 μ up to 248 μ in specimen A, and up to 200 μ in specimen B. The principals may be 38—65 μ or more long and the terminals roughly about as long as the principal they belong to. As examples of the relative length of principals and terminals in the oxyhexaster of various sizes may be taken the following four cases of measurements from specimen A.

Diametre	Length of principal	Length of terminal
172 μ	38 μ	57 μ
183 μ	65 μ	61 μ
229 μ	61 μ	69 μ
248 μ	73 μ	76 μ

The terminals number usually 3 or 4, more rarely 2 or 5, to a principal. They are straight or nearly so, and strongly divergent.

During my studies on the species I have come across a few cases of the tylohexaster which were quite of an appearance comparable to that of *F. occa ouwensi* (Pl. XII, figs. 12, 13). Two cases measured of them were 72 μ and 76 μ in diametre. Possibly they were extrinsic spicules. Even if they were not, their extremely rare occurrence should give them practically no great taxonomic importance.

The uncinate seems to agree with that of *F. occa* in all essential points.

Finally, from among a number of *Farrea* fragments obtained at Stat. 266, a spot quite near that whence came the two specimens described above, I have picked out some which could be identified with the present species. They were all small pieces of the tube wall about as thin and elastic as that of *F. occa occa*. They contained numerous oxyhexasters of an unusually large size (150—210 μ diametre), besides some spiro-anchorate clavules which were discovered after much searching.

Remarks. — The presence of the spiro-anchorate clavule at once suggests the close affinity of the species to *F. occa claviformis* Wils. (western coast of Mexico) and *F. convolvulus* F. E. Sch. (coast of California), both which possess the same type of clavule together with others of a different type. However, the former differs from *F. spirifera* chiefly in the second type of dermal clavules being smooth-clavate instead of pileate; in the spiro-anchorate clavule having much longer shaft which at one point gives out a spur-like spine; and in the oxyhexaster being much smaller. The latter species may perhaps be said to differ in a less degree from *F. spirifera*, its chief difference from this being limited to this, that its spiro-anchorate clavule, besides being apparently much longer, is provided at one point of the shaft with 3—5 branch-like spines which are twisted around the shaft and that its oxyhexaster is much smaller, probably not exceeding 120 μ in diametre. Not unlikely it may prove in the future that *F. spirifera* is not

specifically separable from *F. convolvulus*, and this again from *F. mexicana* Wils. in which the dermal anchorate clavule may sometimes show the terminal anchor in a state of being slightly spirally twisted.

10. *Farrea lendenfeldi* n. sp. (Plate XIII, figs. 16—27).

Stat. 267. 5° 54′ S., 132° 56′.7 E. 984 m. Fragments.

Diagnosis. — Stock of wide tube with moderately thick wall. Dictyonal latticework with meshes in many layers. Dermalia and gastralia weakly microtubercled. Dermal clavule mostly with smooth, oblong-obovate head, rarely pileate. Gastral clavule comprises the same smooth-headed form besides the characteristic umbellate-anchorate form, in which the head is capped with a hemispherical or semiovoid umbel up to 57 μ in transverse diametre and consisting of a central convex disc with 10—16 long, marginal teeth, and in which the shaft bears a varying number of spur-like or finger-like processes, a short distance from the anchor. Hexasters: commonly oxyhexasters of 38—53 μ diameter, with principals distinctly shorter than terminals; occasionally tylohexaster of a similar general appearance.

Description. — Together with *F. occa subclavigera*, *F. occa cuspidata* and *F. spirifera*, there were obtained at Stat. 267 (near southern end of Great Kei I.) some fragments of *Farrea* which undoubtedly represent a new species. I take pleasure in naming it after the late Prof. R. v. Lendenfeld, the distinguished spongologist of Prague. In all probability the fragments are from one and the same stock, of which the original habitus cannot be told, except that it consisted of a rather thick-walled tube or tubes of an unusually large calibre. In pl. XIII, fig. 16 is shown the largest of the pieces. It represents a short irregular tube about 20 mm. in diametre, broken off at both ends, and showing on one side two unequally large, oval openings which are evidently natural ones, as judged from the uninjured state of the obtuse wall edge surrounding them. The wall is 1.25—2 mm., at places even over, in thickness. On the dermal side it is uneven, owing to some rugose elevations of the surface. The gastral surface is on the whole smoother. Both surfaces are dotted with small pit-like depressions which, in the uninjured parts, are seen to be covered over by a delicate latticework, either dermal or gastral, as the case may be. The larger pits on the dermal surface may be nearly half a millimetre in diametre. A number of *Palythoa*-like Anthozoa are found lodged on the dermal surface.

Spiculation. — As might be anticipated from the considerable thickness of the wall, the dictyonal framework in sections exhibit the meshes in many superposed layers. On the gastral side of the wall the primary, rectangularly intersecting arrangement of beams — with meshes of, say, 400—500 μ length — is fairly well recognizable, though, actually, the regularity is much disturbed by beams of secondary addition. In the peripheral and by far the greater part of the wall thickness, the meshwork is quite irregular. The dictyonal beams reach 75 μ in maximum thickness; they are as a rule smooth, but may exceptionally show some tuberculation in limited areas, aside of that which characterizes the external and internal spikes as usual. Oxyhexactine microdictyonalia of 130—150 μ axial length are attached in abundance to the dictyonal beams.

Dermal pentactins have rays usually faintly on surface, 160—237 μ (mostly about 216 μ) long and up to 13 μ thick at base. The cruciate paratangentials are gently arched. A low

swelling in place of the atrophied distal ray sometimes exists, though generally no trace of it is found. The microtubercles on the rays are seldom distinctly conical. — Gastral pentactins are like the dermal; only the rays are on the whole slightly longer and the roughness of surface perceptibly more pronounced.

Dermal clavules are mostly of the peculiar smooth-clavate or bulbous-headed kind, shown in pl. XIII, figs. 23 and 24. They occur in abundance, often several together in bunches. The length varies a great deal, measuring 280—600 μ. The head in lateral view is oblong-obovate, rounded or slightly flattened at top and gradually passing below into the slender shaft, and either quite smooth or showing a slight indication of some longitudinal furrows on surface. It is of a varying transverse diametre, which is generally 38—30 μ, but may not infrequently fall down to 23 μ or even 19 μ. Both in shape and dimensions the head differs somewhat strikingly from that of the similar clavule of *F. occa clavigera*, *F. occa mammillata* or *F. occa cuspidata*. When relatively very small, the head may sometimes bear around its middle a circle of more or less rudimentary teeth (fig. 25), thus linking the smooth-bulbous-headed variety of dermal clavules to the ordinary pileate. The latter (fig. 26) occurs but rarely as the dermal clavule. It is 288 μ long; the convex cap shows an umbo-like prominence at the apex and is furnished with about 20 marginal teeth. Further, a few cases of the highly characterized umbellate-anchorate clavule, which will next be described as the gastral clavule par excellence, were observed occurring on the dermal side in quite natural disposition.

As the most characteristic spicule of the species may be given the umbellate-anchorate gastral clavule, shown in pl. XIII, figs. 17, 18 and 27. This occurs in moderate abundance at some places of the gastral surface but sparsely at others. The dimensions fluctuate considerably, ranging in length from 164 μ to 384 μ. The head consists of a relatively large, convex, central disc which bears on the margin 10—16, moderately long, tapering and sharply pointed teeth, all together making up a hemispherical or semiovoid umbel not unlike that of certain amphidiscs. The umbel, when small, may be only 27 μ long and about as much in diametre; but there exist all sizes of it up to such as measure 38—46 μ in length and 50—57 μ in diametre. The clavule head may be described in short either as pileate with excessively strongly developed marginal teeth or as anchorate with convex disc-like central parts. In a single case of the clavule the teeth were observed to be all slightly inclined towards one side, so that, in top view of the head, they presented a weakly spiral arrangement in the sinistral sense. — A short distance from the head the shaft bears a number of moderately long and slightly bent, spur-like or finger-like processes, standing pretty close together and nearly at right angles to the shaft or somewhat inclined towards its tail end. In the smaller spicule of the kind the processes are very few — say, only 2 or 3 — in number. They are then of a sharply pointed spine-like shape, and occur together with some low tubercles which probably represent rudiments of the same process (fig. 17). In the larger ones of the clavule (figs. 18, 27) the processes in question may number up to 15 or more, and are exquisitely finger-like with rounded free end. There can be no doubt that the processes are the homologue of the shaft-spines, known from the spiro-anchorate clavule of *F. occa claviformis* Wils. and *F. convolvulus* F. E. Sch. as well as from the normally anchorate clavule of *F. aculeata* F. E. Sch. and *F. mexicana* Wils.

The above is not the only gastral clavule. The same smooth bulbous-headed clavule as

that found on the dermal side occurs on the gastral side also. At some places of the latter it is not at all uncommon.

The hexaster of the species is the oxyhexaster (figs. 19, 20) which sometimes assumes the form of the tylohexaster (figs. 21, 22). The former is moderately abundant, the latter less frequent in occurrence. Both are of essentially the same appearance, except of course in the manner of ending of the terminals. They are small, measuring only 38—53 μ in diametre. The principals are moderately thick and long, though distinctly shorter than the terminals. They are often about 0.5 as short as the latter, or even still shorter. The terminals generally number 3 or 4, rarely 2 or 5 to a principal; they are slender, nearly straight except at base, and moderately divergent. Those of the tylohexaster may sometimes keep on nearly the same thickness from base to the minutely knobbed free end.

The uncinate seems to differ in no important points from that of *F. occa*.

Finally may here be mentioned a small specimen from Stat. 208 (5° 39′ S. 122° 12′ E. S. of Muna I., Southern Celebes), which may possibly be a young *F. lendenfeldi* but cannot be exactly determined on account of its badly macerated condition. The specimen is shown in pl. X, fig. 17. The body proper is a short, thin-walled, calyx-like tube showing at the upper end a terminal osculum of 18 mm. by 7 mm., and the inferior somewhat contracted end passing over into an irregularly branching compact basal mass of a disproportionately large size. The dictyonal wall consists of the usual latticework with rectangular meshes in 2—1 tiers in the thickness of the wall. The beams are smooth. In the lower parts of the calyx microhexactins are attached to the beams in profusion. Almost the only loose spicules, left to the specimen, are a number of small tylohexasters not exceeding 48 μ in diametre and which in their general appearance seem to agree well with the same of *F. lendenfeldi*.

Indeterminable Farreids.

A number of *Farrea* specimens collected by the "Siboga" and specifically not exactly determinable, have already found mention in connection with one or the other of the forms described above. There still exist in the collection several more indeterminable Farreas or Farreids, all more or less fragmentary and completely macerated or washed-out, which it would be futile to describe in detail. I therefore limit myself to giving the following records of them.

Stat. 89 (Pulu Kaniungan Ketjil, E coast of Borneo; 11 m.). A small fragment of a thin-walled skeletal tube.

Stat. 12 (between Kangeang I. and Bali I., Bali Sea; 289 m.). A fragment consisting of anastomosing, rather thick-walled tubes up to 9 mm. in diametre.

Stat. 215[a] (near Kabia I., Flores Sea; 500 m.). A. piece of dictyonal skeleton, thick-walled, ridged on the external surface, comparatively slender-beamed but remarkably large-meshed, the rectangular meshes of the gastral side reaching 900 μ in length.

Stat. 259 (N. of Kei Is.; 487 m.). Small fragments which might be almost any one of the known *Farrea* species.

Stat. 266 (near southern end of Great Kei I.; 595 m.). Small fragments of *Farrea*, together with others which could be identified with *F. occa cuspidata* and *F. spirifera*.

Stat. 267 (near southern end of Great Kei I.; 987 m.). A stock consisting of anastomosing tubes with dictyonal latticework, single-layered for the most part. Not satisfactorily identifiable with any of the Farrea forms obtained at the same station.

Stat. 280 (off eastern end of Timor, 1224 m.). *Lonchiphora* sp. pl. X, fig. 18. The dead and completely water-washed fragment shown in natural size in pl. X, fig. 18, possibly represents a species referrible to *Lonchiphora*, a new remarkable Farreid genus which will be described by me in another publication and is characterized, amongst some other points, by the dermal sceptrule being in the form of the lonchiole. It is an irregularly concavo-convex plate with a thickness of about 1 mm. at most places. The figure shows the specimen as viewed from the concave (dermal?) side. It is perforated by a large round aperture of about 6.5 mm. diametre. The lip of the aperture is gently bent, so as to project on the concave side of the specimen as a slight ring-wall. The plate edge seems to be damaged throughout, except at one roundedly incurved place which seems to represent a part of the margin of a second and larger aperture with the lip again flexed towards the concave side of the specimen. No pedicle or point of attachment to the substratum exists in the specimen. However, I deem it highly probable that one end of it, where the wall reaches the greatest thickness of about 3 mm., was originally in close proximity to an attachment base, and that this base stood out on the convex side of the specimen. Taking all in all, the specimen is of a configuration which strongly suggests its being a fragment from a more or less horizontally expanded and undulating plate like the body wall of the *Lonchiphora* (*L. inversa*) known to me from the Sagami Sea. If I am right in drawing analogy from that genus and species, the convex side of the specimen is the gastral, and the concave side the dermal; and the perforations with the margin flexed towards the concave side may be taken for an inceptional stage in the formation of the tubular wall parts found in the species referred to, which tubular parts have the dermal surface on the outside and the gastral surface on the inside.

On both sides the specimen, consisting as it does of the dictyonal skeleton only, presents a granulated and finely porous appearance. In this respect a distinction can scarcely be made between the two surfaces. In parts where the superficial layer of dictyonal structure has been rubbed off, there can be discerned some dictyonal beams forming two sets of fibres intersecting each other at right angles. Examined under the microscope, the dictyonal meshes are of a more or less irregular shape, measuring under 300 μ across. The beams are smooth, up to 93 μ thick and frequently traversed through by two axial canals running alongside each other. The nodes are in part slightly swollen hexactin centres, and in part mere junctions of rays belonging to different hexactins, apparently as a result of the primary Farreid dictyonal latticework having been reinforced by irregularly oriented dictyonal hexactins of secondary formation. Numerous small oxyhexactins of about 70 μ ray length are found attached to the beams. Rough spikes on both sides of the wall are of a finger-like shape.

Finally it may be noted that the specimen somewhat resembles *F. occa* var. *foliascens* of Topsent (1906, figured in 1904, pl. VI, fig. 1). The regularly rectangular-meshed skeleton ascribed to that form may well change into the irregular-meshed condition described above with advance in age of individuals.

Subtribe b. SCOPULARIA F. E. Schulze, s. ext.

Scopularia, F. E. SCHULZE, 1886, p. 70; 1887, p. 289.
Inermia partim, F. E. SCHULZE, 1886, p. 84; 1887, p. 341.

Hexactinosa with sceptrule in the form of scopule, or without any sceptrule.

Subtribe Scopularia is here made to comprise the Hexactinosan families Euretidae F. E. Sch., Tretodictyidae F. E. Sch., Aulocalycidae n. fam., Aphrocallistidae Gray and Craticularidae Rauff, as against subtribe Clavularia which consists of the single family Farreidae F. E. Sch. (See p. 126).

The primitive non-canalized state of the dictyonal skeleton, i. e., the state in which distinct canalar passages, wider than the width of ordinary dictyonal meshes, are yet undeveloped as in the Farreidae, persists as a rule in the Euretidae and the Aulocalycidae. Exceptions to the rule are the Euretid genus *Ptychodesia* with its peculiar amararhysis (p. 116) and certain other forms (as, f. i., the new Aulocalycid genus *Tretopleura*) which have given development to either epirhytic pits or both epirhytic and aporhytic canals of extradictyonal or cavaedial origin (p. 120). Other families of the subtribe have developed each a characteristic canal-system of its own, viz., the schizorhysis (p. 116) of the Tretodictyidae, the diarhysis (p. 118) of the Aphrocallistidae, and the intradictyonal epirhysis and aporhysis (p. 119) of the Craticularidae.

The dictyonal wall is usually moderately thick from the beginning of its existence at the growing margin of the sponge, and consists at that inceptional stage already of dictyonal hexactins arranged in more than one, or several, tiers in its thickness. Those hexactins are not always so oriented as will invariably bring forth dictyonal meshes of a regularly quadrate or rectangular shape, but are frequently of such a relative orientation as will form triangular- or irregular-shaped meshes between them; internodal beams which are often simple hexactin rays instead of being always lateral amalgamations of two rays belonging to adjacent hexactins, and dictyonal nodes which are in part hexactin centres whither converge six or more than six beams and in part merely points of rays, belonging to different hexactins.

Family EURETIDAE F. E. Schulze, 1886, s. ext.

Euretidae partim, ZITTEL, 1877. — F. E. SCHULZE, 1899*a*, p. 68; 1904, p. 177.
Euretidae, F. E. SCHULZE, 1886, p. 70; 1887, pp. 289, 391; 1899*a*, pp. 106—109. — RAUFF, 1893, p. 190.
Maeandrospongidae partim, F. E. SCHULZE, 1886, p. 84; 1887, pp. 341, 402.
Coscinoporidae partim, F. E. SCHULZE, 1886, p. 76; 1887, pp. 320, 396; 1904, p. 178.
Dactylocalycidae partim, Ijima, 1903, p. 25. — F. E. SCHULZE, 1904, p. 180.
Chonelasmatidae partim, >Pleurothyrisidae, Ptychodesidae, etc., SCHRAMMEN, 1910—12.

Scopularia with wall usually not canalized, exceptionally developing either amararhysis or epirhytic depressions but unaccompanied by aporhysis. Skeletal framework may be essentially similarly structured as in the Farreidae, but frequently deviates from this in showing meshes of a triangular

or irregular shape and certain nodes which give off more than six internoda beams, these being in part singly running hexactin rays and in part amalgamations of two rays, belonging to different adjacent hexactins. Scopule generally present, but may sometimes be wanting.

In body shape the Euretids exhibit fully the same range of variation as the Farreids and over. As a new shape, which not infrequently occurs, may be mentioned the vasiform, bearing on the sides tubular branches with accessory osculum at the outer end and internally opening into a wide common gastral cavity.

Intradictyonal canals do not occur, except the amararhysis in *Ptychodesia*. Extradictyonal epirhytic depressions, shallow or pit-like, may sometimes be present but are not accompanied by a similar development of aporhysis (as, f. i., in *Gymnodictyum variolosum* n. sp. (Ij. MS.)).

Dictyonal framework is made up of hexactins which, like those of the Farreidae, have straight rays, as a rule not longer than the side they form of the meshes. The meshes are commonly quadrate, rectangular or triangular, and not infrequently more or less irregular in shape. They are usually all small. The reticulation often grows more or less markedly denser and less regular towards the external, or both external and internal, bounding surfaces of the wall (*Periphragella*, *Chonelasma* s. restr., *Ptychodesia*). Internodal beams are either singly running hexactin rays or amalgamated combinations of two rays from adjacent hexactins. Where both the kinds of beams converge to a common node, this is "multiradiate", i. e., giving off radially one or more beams in excess of the six proper to it as a hexactin centre, and the meshes directly around that node are generally in part triangular and in part quadrangular or may under circumstances be all triangular in shape. The arrangement of beams around the node is then more or less "rotulate".

Dermalia vary from being pentactine with or without an indication of the atrophied sixth (distal) ray to being hexactine with pinularly developed distal ray. It is a remarkable fact that in some forms the dermalia seem to be entirely or almost entirely absent, and that apparently in their normal state. — Gastralia similar to dermalia of the same species, with the exception of *Conorete* and *Bathyxiphus* in which the former may comprise, or are all, pentactins, while the latter are exclusively hexactine pinules. — Hexaster various. — Scopule and uncinate generally present; exceptionally both appear to be wanting (as, f. i., in *Margaritella*), or the former is unknown though the latter seems to exist (*Myliusia*, *Dactylocalyx*).

Of the fossils, the Pleurothyrisidae Schram. 1910—12 (with the living representative *Pleurochorium*) and the Ptychodesidae Schram. l. c. (represented by the living *Ptychodesia*) are surely to be brought under the Euretidae. The same may probably be said of Schrammen's (l. c.) Hapalopegmidae, Botryosellidae, Balantionellidae and Polythyrisidae, all of which have been regarded by him as Hexactinosa incertae sedis.

I find it extremely difficult to draw up a differential key to the living genera of the family, which might be of practical use. This is owing in part to inconstancy of character in some genera and in part to the fact that not a few of them are as yet but very imperfectly known. The following is a list of the living genera, with a statement of prominent distinctive features appended to each.

Genera of the Euretidae F. E. Sch., s. ext.

1. *Eurete* Semper, 1868. Tubular, branching and anastomosing. Dermalia and gastralia pentactins. With oxyhexaster only. Genotype: *E. bowerbanki* F. E. Sch., 1886.
2. *Pararete* n. g. Differing from above by having discohexaster instead of oxyhexaster. Genotype: *P. farreopsis* (= *Eurete farreopsis* Cart., 1877).
3. *Pleurochorium* Schrammen, 1910—12. Like *Pararete* but distinguished by having conspicuous plate-like or collar-like external appendages in serial succession which seem to develop in connection with lateral oscula. Genotype: *P. schulzei* Schram., 1910—12.
4. *Periphragella* W. Marshall, 1875. Cup-like or vase-like with simple or anastomosing tubo-branches on sides. Oxyhexaster, commonly together with discohexaster. Genotype: *P. elisae* Marsh., 1875.
5. *Lefroyella* W. Thomson, 1877. Vase-like or tubular, moderately large. Wall longitudinally folded; lateral oscula on external ridge of folds; gastral side of a fluted appearance. Genotype: *L. decora* W. Thoms., 1877.
6. *Myliusia* J. E. Gray, 1859. Cup-like with osculated outbulgings on sides. Dictyonal skeleton with beams, showing spinules which tend to be arranged in transverse rows, and with swellen nodes bearing spinulated wart-like prominences. Genotype: *M. callocyathus* Gray, 1859.
7. *Margaritella* O. Schmidt, 1880. Cup-like, the wall consisting of a connected system of tubes and intercanals. Oxyhexaster and tylohexaster. Only species: *M. coeloptychioides* O. Schm. 1880.
8. *Chonelasma* F. E. Schulze, 1886, s. restr. Probably of a widely expanded funnel-like shape. Dictyonal skeleton widely rectangular-meshed in the greater part of its thickness; more closely and irregularly meshed in superficial parts, though exhibiting on the surface some meshes, much wider than others in their surrounding and leading internally, not into canals (which are in fact wanting), but directly into ordinary dictyonal mesh-spaces with rectangular sides. Dermalia and gastralia pentactins with paratangentials prominently spiny on the outer side. Hemihexastrous and hexactinoid discohexasters among hexasters. Genotype: *C. lamella* F. E. Sch, 1886.
9. *Ptychodesia* Schrammen, 1910—12. Lamellar or bowl-like in habitus. Dictyonal wall as in *Chonelasma* s. restr., but showing amararhysis. Dermalia and gastralia are pinular hexactins. Discohexaster only. Genotype: *P. doederleini* (= *Chonelasma doederleini* F. E. Sch., 1886).
10. *Conorete* n. g. Like *Eurete* or *Pararete*, but with pinular-hexactine dermalia. Gastralia are pentactine and hexactine pinules, or exclusively the latter. Either discohexaster or oxyhexaster only. Genotype: *C. erectum* (= *Eurete erectum* F. E. Sch. 1899*a*).
11. *Bathyxiphus* F. E. Schulze, 1899. Sword-blade-like. With pinular-hexactine dermalia and simple pentactine gastralia. Oxyhexaster only. Genotype: *B. subtilis* F. E. Sch., 1899*a*.
12. *Gymnorete* n. g. Stock of a network of tubes or of flattened branches in which the lumen may be obliterated. Without dermalia and gastralia. Discohexaster and onychohexaster; the latter in part hexactinoid. Genotype: *G. alicei* (= *Eurete alicei* Tops., 1901*b*).
13. *Heterorete* Dendy, 1916. Like *Pararete*, but without dermalia and gastralia. Probably floricome-like discohexaster only. Only species: *H. pulchra* Dendy, 1916.

14. *Dactylocalyx* Stutchbury, 1841. Cup-like or expanded-funnel-like, large, thick-walled; externally with sinuous radial grooves, and internally with round or oval apertures showing tendency towards an arrangement in radial lines (cavaedial aporhytic apertures?). Some of the larger tubercles on dictyonal beams again microtubercled on top. A not satisfactorily known genus. Genotype: *D. pumiceus* Stutchb., 1841.
15. *Iphiteon* (Val.) Bowerbank, 1869. An incompletely known genus. Irregularly cup-shaped, large. Dictyonal framework with triangular meshes forming confluent rotulate areas; beams weakly tubercled. Only species: *I. panicea* (Val.) Bwbk., 1869, of which the type is the unique specimen from Porto Rico, preserved in the Museum of the Jardin des Plantes in Paris (not the two other specimens in the same museum labelled with the same name but with locality given as Martinique, both which are identifiable with *Dactylocalyx pumiceus* Stutchb.).

In the "Siboga" collection are represented the six genera: *Eurete*, *Pararete*, *Pleurochorium*, *Periphragella*, *Lefroyella* and *Myliusia*.

Genus **Eurete** Semper, 1868.

Eurete Semper, 1868.
Eurete partim, F. E. Schulze, 1886, p. 70; 1887, pp. 289, 392; 1904, p. 143.

Euretids tubular, branching and anastomosing. Dermalia and gastralia pentactins. With only oxyhexaster.

In supplement to the above diagnosis it may be noted that the dictyonal meshes are very commonly of a triangular shape; that the superficial dictyonal nodes (particularly of the dermal side) may or may not be swollen on the external side in a boss-like manner; and that the oxyhexaster, generally distinctly over 50 μ in diametre, has the principals either very short or moderately long, in the latter case reminding one of the same hexaster of *Farrea*.

Not less than twelve species have hitherto been described assigned to genus *Eurete*. They are:

1. *E. simplicissimum* Semper, 1868.
2. *E. marshalli* F. E. Sch., 1886.
3. *E. schmidti* F. E. Sch., 1886.
4. *E. bowerbanki* F. E. Sch., 1886.
5. *E. spinosum* v. Ldfld., 1915.
6. *E. farreopsis* Cart., 1877.
7. *E. carteri* F. E. Sch., 1886.
8. *E. gerlachei* Tops., 1901*a*.
9. *E. semperi* F. E. Sch., 1886.
10. *E. annandalei* Kirkp., 1908.
11. *E. erectum* F. E. Sch., 1899*a*.
12. *E. alicei* Tops., 1901*b*.

Of the above, Nos. 1—5 I retain in genus *Eurete*. The rest I dispose of in the following way: Nos. 6—9 are made a new genus *Pararete*, as being distinguishable from *Eurete* s. str. by having the discohexaster instead of the oxyhexaster. No. 10 appears well receivable into the remarkable genus *Pleurochorium* described by Schrammen (1910—12). No. 11 is made a new genus *Conorete*, characterized by having dermalia in the form of pinular hexactins. Lastly, No. 12 is also made a new genus *Gymnorete*, a striking feature of which is the total absence of dermalia and gastralia as in *Heterorete* Dendy. A second exquisite species of *Gymnorete* is known to me from Sagami Sea (*G. variolosum* n. sp. Ij. MS.).

The "Siboga" has obtained two old species of Eurete, *E. marshalli* and *E. schmidti*, the latter being represented by two new subspecies (*treubi* and *kampeni*). Besides, she has added two new species (*E. trachydocus* and *E. freelandi* to the list of *Eurete*).

1. *Eurete marshalli* F. E. Schulze, 1886. (Plate XIV, figs. 21—24).

Eurete marshalli F. E. Schulze, 1886, p. 72; 1887, p. 297, pl. LXXIX, figs. 1—4.

Stat. 260. 5° 36'.5 S., 132° 55'.2 E. 90 m. 1 specimen and fragments.

Diagnosis. — Stock of a moderately dense network of tubes, less than 5 mm. in diametre. Dictyonal framework made up of nearly smooth beams under 30 μ thickness; nodes scarcely or but little swollen, except those superficially situated which are swollen on the external side into sparsely tubercled bosses, each with a small finger-like spike; the meshes small, under 200 μ length, triangular or irregularly quadrangular in shape. Scopule in one kind, small, 170—230 μ long; with nearly straight and little divergent head-branches 26—31 μ long and ending each with a small, minutely barbed, bulbous swelling. Oxyhexaster 39—62 μ in diametre, with short principals each bearing 2—4 μ long and slender terminals.

Description. — To F. E. Schulze's *Eurete marshalli*, which was first described from specimens collected by the "Challenger" at a spot near Little Kei I. (140 fms.), are probably to be assigned a specimen and some few fragments which the "Siboga" obtained at her Stat. 260, west of Great Kei I. The nearly complete specimen in question is shown in pl. XIV, fig. 21. It consists of a moderately dense plexus of tubes, making up a clumpy stock of about the size of a walnut. The tubes are of a rather small calibre, measuring only 3—5 mm. in diametre. The wall may be at places about 1 mm. thick, but is at most other places considerably thinner. Oscular openings are 4 mm. or less in diametre. Some fragments in the same bottle as the above specimen show that the tubes may sometimes expand at the oscular end in an irregularly funnel-like manner, acquiring there a diametre much longer than that indicated above.

Spiculation. — The dictyonal framework is characterized by a weak development of the beams and nodes (pl. XIV, fig. 24), being in that respect nearly comparable to *Pararete baliense* n. sp. and *P. kangeanganum* n. sp. The beams are usually only 20—30 μ thick, the surface being smooth or showing microtubercles in scattered distribution. All the deeply situated nodes are scarcely or but little swollen; only those most superficially situated are swollen on the external side into moderately prominent bosses. These bosses measure 55—85 μ across from side to side and are set with a sparse but varying number of tubercles which are often not quite regular in shape and may thus give them a somewhat irregularly tuberous appearance. On the gastral side of the wall similar bosses may occur but are here mostly much more weakly developed than on the dermal side. The meshes of the dictyonal reticulum are generally triangular or subquadrangular in shape, mostly measuring 100—200 μ, seldom 220 μ, in greatest width. The above observation on the dictyonal skeleton does not quite agree with F. E. Schulze's representation of the same in his pl. LXXIX, fig. 2 ("Chall." Rep.). The disparity may be in a measure due to the schematic composition of that figure.

Dermal and gastral pentactins have paratangential rays slightly curved so as to be convex on the outside, 100—165 μ long, about 6 μ thick at base, gently tapering towards their rounded end, sparsely and inconspicuously tuberculate or smooth, except in the subterminal parts which are distinctly tubercled and rough. The proximal ray is about as long as the paratangentials. A low tubercle is usually present in place of the atrophied distal ray.

The scopule (pl. XIV, fig. 23) is small and weakly developed. Its length 170—230 μ. The head-branches are 26—31 μ long and number 2—4 (commonly 3, very seldom 6) to each scopule. They are nearly straight, each consisting of a small, minutely barbed terminal bulb and of a slender, finely rough shaft. The scopules are found in greater abundance on the gastral than on the dermal side of the wall.

The oxyhexaster (pl. XIV, fig. 22) occurs in moderate abundance. It is relatively small, measuring 39—62 μ, mostly about 50 μ, in diametre. Each short principal bears 2—4, commonly 3, long, slender and nearly straight terminals. Rarely the oxyhexaster is met with in the form ot a hemioxyhexaster, in which 1—3 principals are monoterminal while the rest are biterminal.

Uncinates of various dimensions, up to 1.2 mm. or over in length and 9 μ in thickness, are common in certain parts, running longitudinally in the tube wall. The barbs, distributed all around the shaft, are not adnate to the shaft surface but slantingly outwardly directed.

2. *Eurete trachydocus* n. sp. (Plate XIV, figs. 25—29).

Stat. 251. 5°28′.4 S., 132°0′.2 E. 204 m. 1 specimen.

Diagnosis. — Stock of rough-surfaced branching tubes. Dictyonal framework subtriangular, subquadrangular or irregularly meshed: the beams strong, profusely and rather coarsely tubercled in all parts: the nodes swollen as a rule: the superficial nodes with moderately well developed external bosses which, however, may sometimes be indistinct: most bosses, but not all, with a small spike each. Scopule in one kind, small, under 270 μ length: the head-branches 3 or 4 in number at a time, straight or slightly curved, 46—58 μ long, ending with a minutely barbed bulbous swelling. Oxyhexaster 77—85 μ in diametre, each short principal bearing commonly 2 long terminals.

Description. — This new species is based on the single small specimen figured in pl. XIV, fig. 25. It was separated from the numerous *Eurete* material obtained by the "Siboga" at her Stat. 251, south of Kur I., one of the Kei Is.

The specimen is a rough-surfaced and rather irregularly contoured tube, divided into three short branches in the upper parts and exhibiting a small attachment surface on one side of the lower end. Height 25 mm. The thickness of the tube near the base is about 4 mm. and reaches up to about 6 mm. in the upper parts. The wall is about 1 mm. thick. The oscula at the end of the branches are of a more or less lobate outline. A number of much smaller lateral oscula of a roundish shape exist on the stem-tube. These are frequently, but not always, surrounded by a raised margin. Some of them were filled up and closed manifestly by secondary formation of spicular tissues, leaving small depressions in their place. The specimen, when left to attain fuller growth, may have possibly acquired a habitus and external characters closely resembling same of *E. schmidti treubi* (pl. XV, figs. 1, 2) from the same locality.

The dictyonal framework consists of beams 30—78 μ thick and which are beset throughout with numerous rounded or conical tubercles (pl. XIV, fig. 26). In this profusely tubercled character of the skeleton the species again resembles *E. schmidti trindi*; only the tuberculation in the latter is perceptibly more closely set (cfr. pl. XV, fig. 9). The dictyonal meshes are on the whole irregular in shape, those of approximately quadrangular or triangular shape being relatively rare. Moreover, they vary greatly in size. On or near the dermal surface of the skeleton, unusually small meshes of an oval or subtriangular shape and 50 μ or over in length, are not uncommon by the side of much larger ones which may reach up to 300 μ in length. Those dictyonal nodes which represent a hexactin centre are more or less distinctly swollen. Not infrequently there occur other nodes which have originated by the fusion of beams at the place where these simply meet or cross one another. Such nodes do not show any marked swelling. Nodal bosses are more or less distinctly developed on the external side of both dermal and gastral, superficial true nodes. They may measure 100—150 μ across from side to side. The tuberculation on them is much the same as on the beams and deeply situated nodes. Certain bosses, especially those of the dermal side, are at times ill-defined and relatively not so much pronounced as others usually are. This appears to be due to the fact that the directly adjoining beams have more rapidly grown in thickness than the bosses in prominence. The rough spikes on the bosses of the dermal side are short and small. Not all the bosses seemed to bear the spike. The spikes on the bosses of the gastral side are either similar to, or more prolonged and spine-like than, those of the dermal side.

The dermal pentactin is of the usual character. Its rays, 120—240 μ long, are sparsely microtubercled or nearly smooth except subterminally. There usually exists a conical or dome-shaped knob in place of the atrophied distal ray.

The scopule occurs in a single kind (pl. XIV, figs. 28, 29), more numerously on the gastral than on the dermal side of the wall. It is 200—270 μ long. The head-branches usually number 3 or 4, seldom 2 or 5, to each scopule. They are 48—58 μ long, either straight or perceptibly curved, faintly rough or nearly smooth, and terminate each with a well developed but inconspicuously barbed bulbous swelling, not over 5 μ across. An exceptionally small scopule met with measured 154 μ in total length and only 19 μ in that of the head-branches.

The oxyhexaster (pl. XIV, fig. 27) is common, though not abundant. Diametre 77—85 μ. It is larger and more strongly developed than in *Eurete marshalli*. Each short principal bears commonly 2, sometimes 3, straight terminals.

The uncinate was met with in some number. A large one measured was 2.3 mm. long and about 10 μ thick. And in that spicule was ascertained the fact that the barbs exist all around the shaft throughout its length, not in a longitudinal biserial arrangement as in the same spicule of *E. schmidti* F. E. Sch.

Remarks. — This new species is one apparently very nearly related to *E. marshalli* F. E. Sch., but differs from this markedly in the much more strongly developed and profusely tubercled dictyonal skeleton (cfr. pl. XIV, figs. 24, 26), in the larger and stronger scopule, and in the larger size of the oxyhexaster. — From *E. schmidti* F. E. Sch. it differs very notably in the total absence of the scopule with head-branches not bulbed at end, and in the uncinates being barbed in the usual manner instead of in two lateral longitudinal series.

3. *Eurete schmidti treubi*, n. subsp. (Plate XV, figs. 1—10).

Stat. 251. 5° 28′.4 S., 132° 0′.2 E. 204 m. Several specimens.
Stat. 254. 5° 40′ S., 132° 26′ E. 310 m. 1 specimen.
Stat. 259. 5° 29′.2 S., 132° 52′.5 E. 487 m. 1 specimen.
Stat. 262. 5° 53′.8 S., 132° 48′.8 E. 560 m. 1 specimen.
Stat. 297. 10° 39′ S., 123° 40′ E. 520 m. Fragments.

Diagnosis. — *E. schmidti* of a habitus like a branching corallum, the tubes anastomosing at wide intervals and bearing on sides numerous prominences or short branches each with an osculum at end. Dictyonal skeleton distinctly tubercled throughout, but most profusely on superficial beams and on both dermal and gastral nodal bosses which are moderately well-developed. Spike on dermal nodal bosses thick and stunted-like or wart-like; that on gastral bosses slender and elongate. Bulbed dermal scopule 220—360 μ long; with 5 or 6, finely rough head-branches divergent from origin, slightly curved almost in their entire length and ending with minutely barbed, fairly large bulb up to 12 across. Bulbless dermal scopule shorter, 135—182 μ long; with 6—9, slender, not laterally compressed, 27—31 μ long head-branches in a tuft-like disposition and each ending with a simple, obtusely pointed or rounded tip. Gastral scopule present in the same two kinds. Oxyhexaster up to 75 μ in diametre, each principal with 2—5 terminals.

Description. — As the type of this new subspecies I have selected the two specimens shown in pl. XV, figs. 1, 2. Both are from Stat. 251, south of Kur I., Kei Is., where they were collected together with *Pararete farreopsis*, *P. semperi*, etc. The stone-hard, moderately thick-walled (up to about 1 mm. thick) tube is 5—8 mm. in diametre. It divides at wide intervals into branches which may anastomose with one another. Besides terminal oscula at the end of branches, which oscula are usually of an oblong (2 mm. by 5 mm.) or a lobate shape, the tube wall shows a large number of lateral oscula at intervals of 2—7 mm. These are mostly roundish, 1—2 mm. in diametre, and have the bluntly edged margin raised more or less in a wall-like or tubercle-like manner or produced into a short branchlet. In some few cases the lateral oscula were transversely oblong with the superior and inferior parts of the margin, produced into two wide lip-like flaps. Sometimes the superior margin alone grows out, thus forming a hood-like covering which makes the osculum open in the downward direction. Owing to a rather crowded occurrence of the above protuberances in relation to lateral oscula, the tubes assume an irregular contour. In its general appearance the entire stock bears a resemblance to the corallum of certain branching Madreporarians (like *Lophohelia*, *Dendrophyllia*). There exist on the stock some solid basal pedestals, by means of which it was attached to the substratum. In the older parts of the stock the gastral lumen is greatly narrowed or may totally disappear, and many oscula in such parts are completely closed up and remain in vestiges as socket-like concavities. All that is evidently due to the inward increase of the tissue of the dictyonal wall.

The dermal surface appears granulated in the wet state of the specimens. On drying it exhibits small but distinct pit-like pores.

Spiculation. — The dictyonal framework (pl. XV, figs. 9, 10) is made up of beams up to 77 μ thick and of more or less swollen nodes. It contains mesh-spaces which are predominantly subtriangular or somewhat irregular in shape, though on the internal surface of

the wall a large proportion of them in succession may be subquadrangular, owing to the intersecting of beam-fibers approximately at right angles. All the beams are beset with small tubercles. The tuberculation is most profuse on superficially situated beams of both external and internal wall surfaces. Superficial nodal bosses of both the sides are likewise densely studded with tubercles. On beams internally situated between the surfaces the tubercles are as a rule more sparse and more weakly developed, while the nodes in those parts are quite or nearly smooth between beam insertions, as are also the superficial nodes on the sides away from the tubercled bosses. External (dermal) nodal bosses (fig. 9) are well developed, measuring 100—165 μ in diametre. The rough spike borne on them are thick, relatively short and rounded at tip. Frequently it is so short as to be wart-like. Internal (gastral) nodal bosses (fig. 10) are less prominently developed than the external and frequently nearly entirely suppressed. The spikes on them vary much in length and strength, being more slender than those of the dermal side and frequently of an elongate subconical or a rather slenderly spine-like shape. Not uncommonly there exist more spikes than one to a node of the gastral side.

In certain parts of the dictyonal skeleton there were found numbers of microhexactins with rough rays of mostly 80—110 μ length and varying strength. They always seemed to stand in connection with dictyonal beams, either directly or indirectly by being attached to others of their kind.

The dermal pentactin (fig. 9) has paratangential rays nearly straight or slightly curved, 110—175 μ long and about 8 μ thick at base. The proximal ray is usually shorter than paratangentials of the same spicule. All the rays are more or less rough on surface, mostly faintly so, and always rounded at end. A slight swelling is present in place of the aborted distal ray. — The gastral pentactin is similar to the dermal, though somewhat larger on the average, the paratangentials frequently reaching 230 μ in length.

The dermal scopule is found in two sharply defined forms, both in great abundance. The larger form (pl. XV, fig. 3) is 220—360 μ long; the smooth shaft is provided with 4, sometimes 5 or 6, bulbed headbranches of 50—69 μ length, which diverge distally right from origin, each being slightly bent outwards. The terminal bulb of the branches is spherically swollen and relatively large, measuring up to 12 μ in transverse diametre; it is armed with minute barbs, except on the top which is finely rough as is also the stalk. — The second and smaller form of dermal scopules (fig. 4) measures 135—182 μ in total length, being distinctly smaller than the corresponding scopule of *E. schmidti schmidti* (figs. 11, 12), besides having quite differently characterized head-branches. The thin smooth shaft thickens at the outer end into a calyx-like knob, from the margin of which there arise 6—9, rarely 4, slender, smooth and bulbless head-branches in a circle, forming a but weakly divergent tuft 27—31 μ long and 15—20 μ broad at the outer truncate end. The head-branches, apparently circular or nearly so in cross-section, taper very slightly from origin to tip which is simply obtusely pointed or rather rounded without showing a sign of external swelling. Frequently I have noticed the extreme tip refracting the light somewhat more strongly than the remaining parts. The distinct knife-blade-like lateral compression that is known of the head-branches in the bulbless scopule of *E. schmidti schmidti* is here not observable.

The gastral scopule is present in the same two kinds as the dermal. The larger bulbed

kind (pl. XV, fig. 5) has the head-branches consisting of a more slender stalk and a distinctly smaller terminal bulb in comparison with the corresponding scopule of the dermal side. The bulbless kind of gastral scopules (fig. 6) is scarcely distinguishable from the same of the dermal side.

The oxyhexaster (fig. 7) is tolerably common. The diametre is usually 65—75 μ; in one case it was found to be only 46 μ. Each short principal bears 2—5, long, slender and moderately divergent terminals. These are somewhat more slender than in *E. schmidti schmidti*.

Long and slender uncinates occur in moderate abundance, mostly disposed obliquely or parallel to the bounding surfaces of the wall. They reach 2.5 mm. or over in length and 15 μ in thickness. For the same spicule of *E. schmidti schmidti* F. E. Sch. has recorded a remarkable structural peculiarity which is observable in the present subspecies also. It consists in the fact that, while in both the attenuated terminal parts the barbs are uniformly distributed all around, the same in the thicker main parts are arranged in two lateral, longitudinally running single-file rows, the two opposite shaft surfaces between the rows being quite smooth (pl. XV, fig. 8). The same arrangement of barbs is distinctly observable on the larger uncinates at least. The two barb-rows are not always quite straight, but sometimes run slightly spirally around the shaft; so that in a side view of the spicule it may happen that, while in some parts of the shaft the barbs are seen along both its lateral sides, in other parts they present themselves in a single row on the surface, the sides then appearing smooth. So far as is known to me, the above arrangement of uncinate barbs is peculiar to the species.

Other specimens of the subspecies are from Stats. 254, 259 and 262, all among the Kei Islands. Each of these stations has yielded a specimen, which, in spite of the macerated condition may confidently be regarded to be of the present subspecies, from the habitus and from examination of the skeleton.

Further, at Stat. 297, off the southwestern end of Timor, were obtained several small and large fragments, presumably of one and the same stock, which may best be mentioned here, though the agreement with the type of *E. schmidti treubi* cannot be said to be complete. Under a far-reaching similarity to that subspecies in both the habitus of stock and the spiculation, the following points of deviation were observed: of the dermal scopules the kind with conspicuously bulbed head-branches seems to be quite rare, while the other kind occurs in abundance and moreover has head-branches which are as a rule tipped each with quite an insignificant knob just perceptible as such, instead of ending in an obtuse point. The latter kind of scopule is on the whole smaller though some of it were found to equal the former in dimensions. As regards the gastral scopules, it would be only proper to say that they are the same as those of the dermal side, but with this modification that even the smallest of them have head-branches ending each with a small but distinctly developed, pinhead-like terminal knob. So that, practically, all the gastral scopules have knobbed head-branches, though the knobs are not of a uniform development in different spicules.

Remarks. — The subspecies I have named in memory of Dr. M. Treub, the late distinguished director of the Botanical Garden in Buitenzorg, Java.

For the relation of the subspecies to *E. schmidti schmidti* and to *E. schmidti kampeni* n. subsp., see the remark under the latter subspecies described next.

4. *Eurete schmidti kampeni* n. subsp. (Plate XIV, figs. 30—35).

Stat. 251. 5° 28'.4 S., 132° 0'.2 E. 204 m. 2 specimens.

Diagnosis. — *E. schmidti* of not exactly known habitus, with small lateral oscula on prominences. Dictyonal skeleton more like that of *E. schmidti schmidti* than of *E. schmidti treubi* in having sparsely tubercled or nearly smooth beams, superficial bosses not very numerously tubercled, and slender finger-like spikes. Bulbed dermal scopule 165—230 μ long; with 2—5, 34—46 μ long, head-branches bent in the basal part and ending each with a small, minutely barbed bulb. Bulbless dermal scopule, which occurs but occasionally, is longer, measuring 230—385 μ, sometimes up to even 495 μ, in length; with 3 or 4, 45—73 μ long, slenderly spindle-shaped head-branches distally drawn out to a sharp point. Gastral scopule nearly all of the bulbed kind. Oxyhexaster 60—89 μ in diametre, with 1 or 2, rarely 3, slender terminals to a principal; predominantly hemihexastrous.

Description. — Among the rich Euretid material from Stat. 251, south of Kur I., Kei Is., there are at least two specimens which represent this new subspecies (pl. XIV, figs. 30, 31). Both are small, irregularly caliculate or fistulous incomplete stocks, not more than 12 mm. high and attached at base to calcareous worm-tubes. Their upper parts have been lost by breakage, so that neither the real habitus of stock nor its dimensions can be exactly given. Some small roundish oscula, not over 2 mm. in diametre, occur on the wall, their margin being more or less raised so as to form low protuberances on the external surface. The protuberances are sometimes developed like a hood, making the osculum open in the inferior direction.

Spiculation. — The dictyonal skeleton may be said to agree in characterization nearly completely with that of *E. schmidti schmidti*. The nodes are swollen. Nodal bosses of both dermal and gastral sides are well developed, measuring 100—165 μ across at base; the tuberculation on them is somewhat more sparse than in *E. schmidti treubi*. They are scarcely distinguishable in appearance from the same of *Pararete farreopsis farreopsis*. The rough-surfaced spikes of both sides of the wall are slender and finger-like. Internodal beams measure up to 65 μ in thickness, and are nearly smooth or sparsely tubercled, the tubercles being nowhere so numerously present as in *E. schmidti treubi*.

Dermal and gastral pentactins have paratangential rays 120—200 μ long, up to 9 μ thick at base, and faintly rough on surface. An insignificant swelling is found in place of the atrophied distal ray.

Of dermal scopules the bulbed kind is the more commonly occurring (pl. XIV, fig. 35). It is 165—230 μ long, of which 34—46 μ appertain to the tuft of head-branches. It is therefore on the whole smaller than in *treubi* (220—360 μ), and much more so than in typical *schmidti* (330—660 μ). The head-branches, 2—5 in number at a time, are more or less bent outwards in the basal parts and accordingly begin to distinctly diverge a short distance from their origin, somewhat as in *Pararete farreopsis farreopsis*. The branch stalk is obsoletely rough; the terminal bulb, not more than 5 μ in transverse diametre, is minutely barbed. The bulbs are of about the same shape and size as in typical *schmidti* (pl. XV, fig. 13), but are distinctly smaller than in *treubi* (pl. XV, fig. 3), besides being not so spherically shaped. — The bulbless dermal scopule (pl. XIV, fig. 34) is relatively rare, unlike as in *treubi* and typical *schmidti* in both

which it is the more abundant of the two types of dermal scopules. It measures 230—385 μ, sometimes 484 μ or even 495 μ in length. It is therefore about as large as in typical *schmidti*, but decidedly larger than in *treubi*. On the other hand, the appearance of the tuft of bulbless head-branches is somewhat more as in the former (cfr pl. XV, figs. 11, 12) than in the latter (cfr. pl. XV, fig. 4). The branches, of which there are 3 or 4 to each spicule, are 45—73 μ long, thickest at a varying distance from origin and distally thinly drawn out to terminate with a finely pointed end. They are not laterally compressed but apparently circular in cross-section as in *treubi*. Thus they may be said to be like a slenderly elongate spindle in general shape, not knife-blade-like as in typical *schmidti*.

Of gastral scopules the common form belongs to the bulbed type, indistinguishable from that of the dermal side. The bulbless type seems to occur but very rarely on the gastral side.

The oxyhexaster, 60—89 μ in diametre, is present in abundance. It has very short principals and long slender terminals (pl. XV, figs. 32, 33). The former are very frequently monoterminal; otherwise they are usually biterminal and rarely triterminal. In fact, the oxyhexaster is far more frequently a hemihexaster than a holohexaster. In the former case it may be that one, two or more of the six principals are monoterminal; thus it is common to meet with such oxyhexasters as show 11—8 terminals in all. A ray made up of a principal and a single terminal is usually distinguished by showing the well-known kink at the junction of the two parts; but sometimes it is quite or nearly straight. There rarely came under observation cases of small six-rayed spicules (75 μ in axial length) which I was greatly inclined to take for hexactinoid oxyhexasters and not for true microxyhexactins.

Rarely also I have, in certain preparations, come across some small discohexaster (30—38 μ diametre) of much the same appearance as that of *Pararete farreopsis*. This I simply mention here without maintaining that it really belonged to the specimen in which it was discovered.

Long and fibre-like uncinates with weak barbation are met with in numbers. On the thicker of them (up to 17 μ thick) I could distinctly observe the peculiar biserial arrangement of the barbs, first called attention to by F. E. Schulze in *E. schmidti schmidti* and seen by me also in *E. schmidti treubi*.

Remarks. — The above subspecies I have named for Dr. P. N. van Kampen of Batavia, now at Leiden.

Now let here be given some general observations on the species and its subspecies.

E. schmidti F. E. Sch., in the broad sense of its consisting of the three subspecies *E. schmidti schmidti*, *E. schmidti treubi* and *E. schmidti kampeni*, exhibits the following common character:

Dictyonal skeleton consisting of smooth or tuberculate beams with thickened nodes; superficial nodes of both dermal and gastral sides swollen on the outer side into tuberculate bosses. Dermal scopules present in two kinds, one with head-branches ending with bulbous swelling, and the other without that terminal swelling. Gastral scopules in the same two kinds or in the first kind only. Hexaster in the form of oxyhexaster with short principals and long slender terminals. The larger uncinates with barbs developed in two lateral longitudinal series.

The typical form of the species, which may be appellated *E. schmidti schmidti*, was first

described by F. E. Schulze (1886, p. 71; 1887, pp. 293, 392, pl. LXXVIII, figs. 1—6) on the basis of specimens from the Philippines (off Zamboanga, 102 fms.) and from Enoshima in Sagami Sea. From his description as wel as from my own observations on a Sagami Sea specimen, the form in special may be characterized as follows:

E. schmidti of a clumpy habitus, consisting of a somewhat close plexus of anastomosing tubes. Dictyonal beams smooth or weakly tubercled. Bosses of superficial nodes distinctly tubercled. Both dermal and gastral spikes slender, finger-like. Bulbed dermal scopule (pl. XV, fig. 13) 330—600 μ long, with 4 or 5 head-branches which are nearly straight or slightly bent in the basal part and consist each of a minutely and densely barbed stalk, ending with a more strongly barbed bulb of a moderate size. Bulbless dermal scopule (pl. XV, figs. 11, 12) occurs in great abundance; generally 250—385 μ (sometimes even 600 μ) long; with head-branches 31—42 μ long, 2—4 in number at a time, slightly laterally compressed like the blade of a knife with the cutting edge turned inwards and the back towards the exterior, and in lateral view narrowed toward the sharply pointed end. Gastral scopules nearly all of the bulbed kind. Oxyhexaster 58—96 μ in diametre, each principal bearing 2, exceptionally 3, terminals.

The above diagnosis of *E. schmidti schmidti* F. E. Sch. I have drawn up for the sake of comparison with those of the subspecies *treubi* and *kampeni* given in this report. With regard to the Sagami Sea specimen studied by me, and which I take for *E. schmidti schmidti*, there is a point which seems to require to be noted. F. E. Schulze ("Chall." Rep., pl. LXXVIII, fig. 2) has represented all the nodes in the entire thickness of the dictyonal wall to be equally densely and distinctly tubercled. That does not agree with my observation on the Sagami Sea specimen. In it I find only the bosses on the outer side of superficialmost dictyonal nodes distinctly tubercled, all the more deeply situated nodes being quite or nearly smooth between beam insertions.

Be that as it may, the most important character of the species, common to all its subspecies, consists in the superficially situated dictyonal nodes being swollen into tuberculate bosses, in the presence of bulbed and bulbless kinds of scopules, and in the larger uncinates showing barbs ranged in two lateral longitudinal series.

E. schmidti treubi n. subsp. differs from *E. schmidti schmidti* mainly in the stock being of a branching and but occasionally anastomosing corallum-like habitus instead of one like a clumpy mass made up of a close plexus of anastomosing tubes; in the superficially situated internodal beams being distinctly and profusely tubercled instead of being smooth or weakly tubercled like those in the deeper parts of the wall; in the dermal spikes being frequently of a stunted or wart-like, instead of a slenderly finger-like, development; in the bulbless scopule being shorter (135—182 μ, instead of 250—385 μ or even 600 μ, long) and having head-branches which are not of a laterally compressed shape, nor are finely pointed at end but obtusely pointed or rounded.

E. schmidti kampeni n. subsp. differs from *E. schmidti schmidti*, so far as can be judged under the circumstances, chiefly in the fact that, of the two kinds of its dermal scopules, the bulbed is the smaller but by far the more numerous, which is the reverse of what we know about the matter in typical *E. schmidti*; in the bulbed scopule being much shorter (165—230 μ, instead of 330—600 μ, long); in the bulbless scopule having head-branches which, besides being longer (45—73 μ, instead of 31—42 μ long) and relatively more slender, are not flattened

by lateral compression but are of an elongate spindle-like shape; in the common occurrence of the oxyhexaster in the hemihexaster form. On the whole the appearance is that *E. schmidti kampeni* differs less widely from *E. schmidti schmidti* than from *E. schmidti treubi*, or these two from each other.

5. *Eurete freelandi* n. sp. (Plate XV, figs. 14—24).

Stat. 105. 6° 8′ N., 121° 19′ E. 275 m. 2 fragments.

Diagnosis. — Stock of anastomosing tubes 4—6 mm. in diametre. Dictyonal beams sparsely and irregularly tubercled, nearly smooth in some parts; nodes scarcely or but little swollen; superficial nodes without boss-like swelling on the outer side, giving rise directly to rough spikes of an elongate, subconical shape. Dermal scopule 250—285 μ long, with relatively thick and short head-branches which are only 19—39 μ long, entirely smooth and generally finger-like in shape or distally gently swollen in a club-like manner. Gastral scopule about as long, with head-branches 30—45 μ long, slender, finely rough, and ending with small, minutely barbed and ill-defined bulb. Oxyhexaster 65—80 μ in diametre, generally in the form of a hemihexaster, with moderately long (13—15.5 μ) principals which may bear 2 or 3, strongly divergent terminals, nearly but not quite twice as long as the principal.

Description. — From among the numerous macerated *Eurete* and *Pararete* fragments from Stat. 105, north of Jolo I., Sulu Archipelago, I have separated two specimens which, though incomplete, have preserved the soft parts and loose spicules and could thus be subjected to a close examination. Both the specimens are shown in pl. XV, figs. 14, 15. I consider them to represent a new species, which will be called *E. freelandi* in remembrance of Rev. Charles W. Freeland who gave me hospitable shelter during my visit to the Sulu Archipelago in 1909.

The larger of the two specimens (fig. 14) is a small complex of anastomosing tubes and probably represents a portion of a larger and rather close-meshed plexus of tubes. The smaller specimen (fig. 15) bears on the external surface some *Palythoa*-like Actinians which are totally missing on the other specimen. Whether the two fragments originated from one and the same stock cannot be definitely told, though they are essentially alike in general character and spiculation. The tubes measure generally 4—6 mm. in diametre. The wall is about 1 mm. thick, showing rather smooth external surface, sprinkled with ostia in the form of small but distinct pits.

Spiculation. — The dictyonal framework is made up of rather weak beams 16—45 μ thick, which exhibit on surface a sparse number of irregularly scattered tubercles, though the spikes are densely tubercled as usual (pl. XV, fig. 16). The tubercles are relatively more numerous on beams near the wall surfaces than on those more deeply situated. The rule seems to be that the tuberculation increases in quantity as the beams grow older and in strength. The nodes of intersection are in part more or less distinctly swollen and then up to 130 μ in diametre. Other nodes are not swollen to any marked degree. The meshes are usually 110—250 μ long, and mostly rather irregular-shaped when seen on sections of the wall, but in no small proportion subquadrangular when viewed on the wall surfaces. The superficial nodes of both dermal and gastral sides are without a boss-like swelling on the outer side, so that the spikes of either side appear to arise directly from those nodes.

The dermal pentactin has obsoletely rough rays rounded at end. The paratangential rays are 143—200 μ long; the proximal ray is about as long as, or somewhat shorter than, the paratangentials of the same spicule. The atrophied distal ray is represented by a low or a somewhat prolonged knob. — The gastral pentactin is similar to the dermal, with rays 110—190 μ long (pl. XV, fig. 16).

The dermal scopule (pl. XV, figs. 17—20) is of a peculiar characterization. By a total spicular length of 250—285 μ, the head-branches are relatively short and thick, measuring 19—39 μ in length. Of these there are commonly 3 or 4, more rarely 2 or 5, to a spicule. They are rounded at tip and in shape simply finger-like or but slightly and gently thickened towards the end without bringing about a distinctly bulbous swelling. Moreover, the branches are perfectly smooth all over. The shaft is smooth, except near the proximal end, in which part there occurs a sparse microtuberculation. The branch-bearing swelling at the distal end reaches 11 μ in transverse diametre.

The gastral scopule (pl. XV, fig. 21) is of a markedly different character. It is 190—253 μ long. The head-branches, of which there are as a rule 4 or 5 to a spicule, are 30—45 μ long, straight, slender, very finely rough on the stalk, and minutely barbed at the end which is swollen into a small bulb not well demarcated from the stalk.

The oxyhexaster (pl. XV, figs. 22—24) is common. It measures 65—80 μ in diametre. The principals are moderately long (13—15.5 μ), each bearing (if not monoterminal) 2 or 3, strongly divergent, straight or slightly curved terminals which are nearly but not quite twice as long as the principal. The oxyhexaster is very commonly, even perhaps constantly, hemihexastrous; that is to say, one or more, but never all, of the six principals are monoterminal. In fact, I have not succeeded in discovering a single case of the oxyhexaster which could with certainty be made out to be a holohexaster. In a single case observed (fig. 24) only one of the principals was biterminal, while all the rest were monoterminal. The monoterminal ray is generally perfectly straight, without showing a kink at the base of the terminal. Possibly the oxyhexaster may rarely occur in the completely hexactinoid form.

Long and slender uncinates are not uncommon. The barbs were observed to occur all around the shaft, unlike as in the same spicule of *E. schmidti*.

From Stat. 97, near Pearl Bank, Sulu Archipelago, there are a few small fragments, the skeleton of which shows resemblance to that of the above described species. Since, however, they are all completely washed-out pieces, no definite identification is possible. Therefore, I have refrained from adding that station as a locality of *E. freelandi*.

Remarks. — The above new species has in common with *E. bowerbanki* F. E. Sch. from Japan and *E. spinosum* v. Ldfld. from off the coast of northern Peru the possession of oxyhexasters which have moderately long principals and approach those of *Farrea* in appearance. Whereas, in all other species of the genus the oxyhexaster has short principals and relatively very long terminals. However, from both the *Eurete* species referred to, *E. freelandi* may readily be distinguished by its peculiar dermal scopule, a like of which is in fact not known from any other species of the genus. From *E. spinosum* it differs very markedly in several other points; from *E. bowerbanki* it seems to be differentiated in a much less degree.

Genus **Pararete** n. g.

Eurete Carter, 1877; Topsent, 1901*a*.
Eurete partim, F. E. Schulze, 1886, p. 70; 1887, pp. 289, 392; 1904, p. 143.

Like *Eurete*, but distinguished by having discohexaster instead of oxyhexaster.

In the habitus of stock and the structure of dictyonal skeleton, this genus is very much like, and scarcely distinguishable from *Eurete* s. str. Superficial dictyonal nodes of the dermal side are usually swollen into distinct bosses, and the discohexaster is usually of a small size under 50 μ, with terminals to each principal, gently bent in **S**-like way and forming a more or less lily-flower-like perianth. An exception in these respects is *Pararete gerlachei*, in which the superficial dictyonal nodes seem to be without the bosses and the discohexaster has strongly divergent terminals and a diametre apparently reaching well up to 70 μ.

As indicated on p. 166, the following four species which have been originally referred to *Eurete*, are now taken under *Pararete* viz.: *P. farreopsis* (Cart., 1877), *P. carteri* (F. E. Sch., 1886), *P. gerlachei* (Tops. 1901*a*), and *P. semperi* (F. E. Sch., 1886). The "Siboga" has obtained three new species, viz.: *P. baliense*, *P. kangeanganum*, and *P. freeri*, bringing up the number of known *Pararete* species to seven in all. Moreover, there were found in the "Siboga" collection the old species *P. farreopsis* (Cart.), represented by the typical form and two new forms which will be called *P. farreopsis subglobosum* and *P. farreopsis jakosalemi*.

1. *Pararete farreopsis farreopsis* (Carter). (Plate XVI, figs. 1—6).

Eurete farreopsis Carter, 1877, p. 122. — F. E. Schulze, 1886, p. 71; 1887, p. 295, pl. LXXIX, figs. 5—8.

Stat. 97. 5° 48′.7 S., 119° 49′.6 E. 564 m. Fragments
Stat. 251. 5° 28′.4 S., 132° 0′.2 E. 204 m. Numerous specimens.
Stat. 254. 5° 40′ S., 132° 26′ E. 310 m. 2 specimens.

Diagnosis. — Stock irregularly clumpy, consisting of indefinitely branching and anastomosing tubes 4.5—7.5 mm. in diametre. Tube wall moderately thick, coarsely porous on surface. Dictyonal framework made up of smooth beams 30—75 μ thick; the meshes may be 300 μ wide. Superficial (both dermal and gastral) dictyonal nodes swollen each on the outer side into a distinct and rather coarsely tubercled boss 100—165 μ in diametre; spikes generally finger-like. Dermalia and gastralia pentactins with rays 200—280 μ long, subterminally rough, smooth or weakly microtubercled in the remaining parts. Scopules of both sides 247—343 μ in total length, with head-branches 52—72 μ long, 2—4 in a bunch, geniculate a short distance from base, divergent above, bulbously swollen at end; the bulb barbed on sides but smooth on top. Discohexaster 30—46 μ in diametre, each short principal bearing 2—5 small-disked terminals forming a tuft like the perianth of a lily.

Description. — The species was first described in great detail by Carter (1877) on the basis of a specimen from the Philippine Islands. Next, F. E. Schulze (1886, 1887) identified with that species a specimen which was obtained by the "Challenger" at a spot near Little Kei I. from a depth of 140 fms. and gave a description of it. Now, in the "Siboga" collection there exist a number of *Pararete* specimens which, in spite of some disparity from both Carter's

and SCHULZE's representations, I am inclined to regard as being identical with the form in question. I may call it *P. farreopsis farreopsis* in subgeneric distinction from other forms of the species.

Of such specimens there are, in the first place, several fair-sized ones, besides a quantity of small fragments, from Stat. 251, a spot to the south of Kur I., Kei Is. Probably they represent several distinct stocks. In pl. XVI, fig. 2 is shown the largest specimen of the lot, preserving the soft parts and loose spicules. Fig. 2, same plate, represents a large fragment which was bleached for the study of the skeleton. The branching and anastomosing tubes are 4.5—7.5 mm. in diametre. The wall is, as usual with all members of the genus, rigidly firm and moderately thick, the thickness varying from about 1 mm. or more in the basal parts of stock to about 0.5 mm. right close to the rim of oscula. The oscula at the end of the tube branches are either roundish and patulous or in various stages of dividing into two, in the manner described by CARTER. Not infrequently the oscular margin is produced at its two opposite parts into broad lobes, which, on union with each other over the osculum, would convert this into two daughter oscula at the end of as many newly formed short branches. Both dermal and gastral surfaces present a rather coarsely porous appearance, due to the occurrence of numerous roundish pores of a varying size under 0.5 mm. width, which are best seen on dried specimens. The larger pores or entrances into pit-like depressions take up a space distinctly larger than an ordinary dictyonal mesh and are surrounded by more than four superficial nodes of the dictyonal framework, while the smaller pores are not larger than the space of an ordinary dictyonal mesh.

The macerated skeleton (fig. 2), when examined in a general way with the naked eye or under the lens, shows a part of its beams as long continuous fibres arranged in intersecting longitudinal and transverse systems much as in *Farrea*, a fact already noted by CARTER. As a matter of fact, however, there exist at the same time numerous other beams which are short and run in indefinite directions; so that, when but a small field of the skeleton is examined under the microscope, the prolonged continuity of the fibres falls out of observation and the reticulum presents itself as an irregularly meshed one, in which the variously sized meshes are mostly subtriangular and only occasionally subquadrangular with rounded corners (pl. XVI, fig. 6). The meshes may be 300 μ wide, but are usually smaller. A small subtriangular mesh may be only 130 μ or thereabout in length. The beams are generally 30—75 μ thick. They are smooth, as is emphatically mentioned in CARTER's description of the type specimen. Here and there a beam is seen to join another at an oblique angle, without forming a marked swelling at the point of junction (false node). On the other hand, all the true nodes (centres of dictyonal hexactin) are more or less swollen. They are seldom sex-radiate, but are far more commonly multiradiate, owing to the hexactin centrum receiving the end of rays that come singly running from other adjacent hexactin centres, as can readily be demonstrated by tracing the acial canals in the beams and the nodes (fig. 6). It is clear that this multiradiate condition of the nodes stands in relation with the meshes being so frequently of a subtriangular shape. In most parts of the wall the nodes occur in three or more irregular tiers in its thickness, and that even at a position quite close to oscular margin. They are all smooth-surfaced like the beams. Tuberculation occurs only on the spikes and on the boss-like swellings on the outer side of the nodes most superficially situated on both dermal and gastral sides of the wall. The tubercled bosses,

which form conspicuous objects in the preparations, are nearly or quite hemispherical, measuring 100—165 μ across from side to side. The tubercles are rather coarse and of a lowly conical shape. The densely tubercled spikes stand commonly singly, not infrequently two or three together, on a boss. They are relatively small finger-like processes, generally not more than 30 μ thick at base, though those of the gastral side may sometimes present themselves in a prolonged (up to 300 μ long) spine-like shape. It is clear from the relations of their axial canal that the spikes represent the free end of dictyonal hexactin rays which either take origin from, or simply pass right through, the superficial node they stand in relation with. As might be expected, those of the former nature project out, as a rule vertically, from the summit of the bosses, while the others do so more or less obliquely inclined from an indefinite point of the boss surface.

The tubercled bosses were mentioned and figured by CARTER, but seem to have been not exactly observed as regards their position and relation to dictyonal nodes. F. E. SCHULZE gave from the "Challenger" specimen a figure (1887, pl. LXXIX, fig. 6) in which the dictyonal skeleton is shown as being of a character ill agreeing with CARTER's representation as well as my own observation, in that all the nodes, irrespective of their position in the entire thickness of the dictyonal wall, are shown to be tubercled on surface and the equally tubercled superficial bosses to be imperfectly or scarcely developed. If that be the real state of things in the "Challenger" specimen, the "Siboga" specimens seem to agree in those respects much better with CARTER's type of the species than with it.

A large number of microxyhexactins are found attached to dictyonal beams in the well known manner (fig. 6). They measure 72—130 μ in axial length. The more slender-rayed of them have the rays distinctly spinulated, while the stronger ones are nearly or quite smooth throughout.

Dermal and gastral pentactins (fig. 6) are similar. The lost sixth ray is sometimes, but not always, represented by a small boss-like swelling. The paratangential rays, 200—280 μ long and 9—15 μ thick at base, are nearly straight or very weakly curved so as to be slightly concave on the inner side. The proximal unpaired ray is about as long, more usually somewhat shorter. All the rays are smooth, or at the most very weakly and sparsely microtubercled, except in the subterminal parts which are always more or less distinctly rough and end with a rounded or obtusely pointed tip. In no place of the sponge surface I have found the pentactins so regularly arranged in relation to one another as to form a quadrate-meshed trelliswork.

The scopule (pl. XVI, fig. 3) is also alike on both sides of the wall. It is 247—343 μ, most commonly about 300 μ, long. The slender shaft is slightly thicker in the middle parts than towards both its ends; it is smooth or nearly so, except towards the sparsely tubercled tail-end. The head-branches number 2—4; they are 52—72 μ long and characteristically bent or geniculate at a point in their course. For a quarter or nearly one-third of their length after origin from the slightly inflated head-end of the shaft, they run close together and nearly parallel one another. After that they bend outwards and begin to diverge. The diverging parts show a perceptible curvature with convexity on the outside. Towards their end the branches gradually thicken and exhibit a finely rough surface, finally to terminate each with a bulbous swelling which is smooth or "bald" on top but is provided with small barbs on the sides. In exceedingly

rare cases I have observed the branches to end each with a smooth or nearly smooth club like swelling which reminds one of the dermal scopule of *Pararete semperi* (F. E. Sch.) (pl. XVI, figs. 27—29).

The hexaster is represented by a small kind of discohexaster (pl. XVI, figs. 4, 5), which occurs commonly in some parts but nowhere in great profusion. Diametre 30—46 μ. The principals are about 4 μ long, the terminals 11.5—19 μ. Each principal bears 3 or 4, seldom 2 or 5, terminals, which show each a slight S-like curvature and together form a perianth-like tuft outwardly expanded en fleur de lis. The terminals are tipped each with a distinct but minute disc showing no or but quite insignificant marginal teeth.

The above discohexaster corresponds without doubt to the smatter variety (7—6000 ths inch = say, 30 μ, in diametre) of the capitate-rayed rosettes described by CARTER from the type specimen. The larger variety (15—6000 ths inch = 64 μ, in diametre) of same should have the principals reduced to nihil, so that the terminals radiate in all directions from the central node. This second discohexaster form I have not discovered in the "Siboga" specimens. Nor does F. E. SCHULZE seem to have found it in the "Challenger" specimen, for he says nothing whatever about it. The only kind of rosettes described and figured by that author from the "Challenger" specimen is quite similar in appearance to the smaller rosette CARTER's as well as to those found by me in the "Siboga" specimens, but apparently differs from either in the much larger size (about 80 μ in diametre, as computed from the scale of magnification of the figure given by F. E. SCHULZE — Chall. Rep., pl. LXXIX, fig. 7 — in the absence of a statement of measurement). Thus, as regards the discohexaster, there seems to exist a discrepancy in one way or another between the specimens of the three different sources referred to. Whatever this difference between the type and the "Challenger" specimen may signify, that between the former and the "Siboga" specimens may, I think, be regarded to be of a relatively trivial nature.

The uncinate is sparsely present. It is of widely varying dimensions. A large one measured $1^1/_3$ mm. long and 10 μ thick in the thickest parts. Another was 750 μ long by 4 μ thickness. All the larger uncinates are of the usual appearance with distinct barbs all around, and appressed against the shaft. A relatively small and thin one of 270 μ length showed but a minute and indistinctly developed barbation. Uncinates of this description seem to grade over insensibly into the smallest which may well be called rhaphidial. These may be only 160 μ long and scarcely 1.5 μ thick, taper uniformly towards both finely pointed ends, and are quite or nearly smooth. All that may remain of the barbation in those rhaphidial uncinates is represented by a weak serration perceivable on the edges of the spicule. This fine sort of uncinates is however altogether rare, occurring in vertical orientation to the wall surfaces together with those of larger dimensions.

Other specimens. From Stat. 254, again among the Kei Is., there are two specimens which, in spite of their being completely macerated, I take no heed in identifying with typical *P. farreopsis* from the character of their dictyonal skeleton. In some parts of the stocks, where the tube measured about 7 mm in diametre, the wall was found to be fully 1.5 mm. thick. In certain other — without doubt old-parts, it was even somewhat over 2 mm. in thickness.

From amongst the fragments of *Pararete farreopsis jakosalemi* n. subsp. and *P. freeri* n. sp.

obtained at Stat. 97 (near Pearl Bank, Sulu Is.) I have picked out a few small ones which may also be identified with *P. farreopsis farreopsis*, especially on account of the agreement with that form in the manner of branching of the tubes and in the characteristic shape of the scopules.

Finally may here be mentioned a small fragmentary and washed-out specimen from Stat. 156 (between Gagi and Jef Fam Islands in Halmaheira Sea) which resembled *P. farreopsis farreopsis* in the character of the skeleton but could not be definitely identified. It consists of a branching tube about 10 mm. in diametre and with relatively thin wall.

2. *Pararete farreopsis fragiferum* n. subsp. (Plate XVI, figs. 13—18).

Stat. 156. 0° 29'.2 S., 130° 5'.3 E. 469 m. 2 specimens.

Diagnosis. — Stock somewhat tuberous and dividing, terminally with osculum of lobed outline and laterally with a number of smaller roundish oscula on top of low prominences. Spiculation essentially as in *P. farreopsis farreopsis* except in the dictyonal beams being tuberculated throughout, in the superficial nodal bosses being conspicuously large and berry-like in appearance, and in the scopules having straight head-branches uniformly divergent from origin. Dermal scopule 300—400 μ long, with head-branches 55—72 μ long; gastral scopule up to 600 μ long, with head-branches 80—90 μ long.

Description. — From Stat. 156, between Gagi I. and Jef Fam I. in Halmaheira Sea, there are two specimens, besides some fragments, which I think can be made to represent a new subspecies or variety of *Pararete farreopsis*. They will here be referred to as specimens A (pl. XVI, fig. 13) and B (same pl., figs. 14, 15) under the name of *P. farreopsis fragiferum*. Both are small but nearly complete stocks, measuring not more than 25 mm. in height. In specimen A the basal parts are wanting, while specimen B stands on a rather broad and compact stalk-like base. In both the main body is of an irregularly tuberous shape, porous on the wall surface and opening by a number of small roundish lateral oscula, 1—2 mm. in diametre. A few of these lateral oscula open directly on the general wall-surface; all the rest are situated singly on tubercle-like prominences or outbulgings of the wall. The stock divides above into two or more short and irregular branches, each of which ends superiorly with a terminal osculum. This is distinguished from the lateral oscula by a large size reaching 5 mm. in width across and by the marginal wall being folded, so that the osculum presents a somewhat irregular or a 3—4-lobed outline (pl. XVI, fig. 15). The lobes clearly represent first stages in the formation of new radial tubes or lateral protuberances, each of which opens by a lateral osculum on the top.

The sponge wall is in most places about 1 mm. or somewhat over in thickness. The gastral cavity is, in conformity to the external shape of the sponge, an irregular space with but little semblance of a tubular lumen. Moreover, a part of it is traversed by some trabecula-like or incompletely septum-like bridges, running across from one point to another of the gastral surface. Thus the habitus of the sponge combines the dichotomously branching feature of many tubular Euretids and that of certain others in which the body is caliculate and possesses numerous lateral tubes open at end (as, f. i., *Periphragella elisae*, *Lefroyella decora*). In view of the apparently young state of the specimens, it is possible that on further growth certain branches inosculate and so bring about anastomosis in the stock.

Spiculation. — The dictyonal framework (pl. XVI, fig. 16) is much like that of *P. farreopsis farreopsis* except in the fact that the beams are tubercled throughout and the superficial nodal bosses are more conspicuously developed. The tuberculation of the beams varies somewhat in its degree in different positions of the skeleton, as well as in different individuals, though on the whole it is not dense but rather scattered. The superficial nodal swellings of the dermal side of wall are hemispherical and large, measuring 100—165 μ, sometimes even 200 μ or thereabout, in diametre. They are densely studded in uniform distribution with moderately large tubercles of a conical or rounded shape, which fact gives them an exquisitely berry-like appearance. Sometimes the boss surface exhibits, in the interspaces between tubercles of an ordinary size, a much finer microtuberculation; but this is by no means a matter of common occurrence. On the gastral side of the wall the bosses may be about as strongly developed as on the dermal side, but are commonly somewhat weaker. The rough peg-like spikes on the nodal bosses are usually short and thin; sometimes, but especially on the gastral side, they are prolonged into a slender spine-like shape.

The dictyonal meshes are subquadrangular and up to about 300 μ wide, or subtriangular and smaller. The beams measure generally 40—62 μ in thickness. In certain parts of the skeleton there are found in a fair number the usual small oxyhexactins attached to the beams.

The loose spicules were preserved in specimen A only. Except the scopules they are essentially similar to those of *P. farreopsis farreopsis*.

The scopule, both dermal and gastral, have the head-branches quite or nearly straight and uniformly divergent from origin, thus bringing forth a regularly conical bunch (pl. XVI, fig. 17). Each bunch consists of 3—5, commonly 4 and seldom 6, head-branches with bulbously swollen and weakly barbed end and with faintly rough stalk. The shaft is likewise faintly rough. Dermal scopule 300—440 μ in total length, the branches 55—72 μ long. Gastral scopule attains larger dimensions, reaching 500 or even 600 μ in total length and 80—90 μ in the length of the head-branches.

Dermal and gastral pentactins are alike. Their rays, 200—265 μ long and over 10 μ thick at base, are subterminally rough and in their other parts only faintly so.

The discohexaster (pl. XVI, fig. 18) is at places fairly common. It measures 30—50 μ in diametre, and is of nearly the same shape as in *P. farreopsis farreopsis*, with 4—6 moderately strong terminals to each principal. The terminals form a tuft, shaped like the perianth of a lily. Occasionally the perianths are broad, in which case the entire rosette presents an almost spherical appearance.

The uncinate is present in varying lengths. It is at the most 10 μ thick. The barbs occur all around the shaft.

3. *Pararete farreopsis subglobosum* n. subsp. (Plate XVI, figs. 19—21).

China Sea. 17° 44′ F., 110° 26′ E. 220 m. 2 specimens.

Diagnosis. — Stock clumpy, subovoidal, consisting of a dense plexus of anastomosing tubes 4—8 mm. in diametre, with numerous short and radially directed branches open at end. Spiculation essentially as in *P. farreopsis fragiferum*, but with somewhat smaller superficial

nodal bosses which are more sparsely and often irregularly tubercled, and with scopules which are on the whole smaller and more slender, not exceeding 500 μ and reaching down to 165 μ in total length and having head-branches of 55—28 μ length.

Description. — This subspecies is based on two beautifully preserved specimens which were kindly given me by Dr. Hanitsch of the Raffles Museum in Singapore. They are a part of the numerous Hexactinellids which were collected by Mr. Maclear Ladds in China Sea (south of Hainang) from a submarine cable recovered from the bottom. I think there exist several more specimens of the subspecies in the museum mentioned.

Both the specimens on hand, one of which is shown in pl. XVI, fig. 19, form a subovoidal stock of about the size of a goose' egg and are made up of a dense plexus of moderately thick-walled (about 1 mm. or over in thickness), anastomosing tubes 4—8 mm. in diametre. On one side of the body there exist several short pedicels which become confluent into a thin but broad attachment plate. On its other, convexly arched side there are seen numerous short and radially directed peripheral branches, each opening by an osculum at the end. These terminal oscula are generally 2—7 mm. in diametre, being roundish or suboval, seldom lobate, in outline. Other oscular openings which are not terminal in position but open directly on tube sides, occur in a limited number. They are generally small (1.5—3 mm. diametre). The intervening spaces between the tubes are on the whole either about as wide as, or narrower than, the diametre of the latter, thus lending to the reticular stock a much more compacted appearance than that of *P. farreopsis farreopsis* (pl. XVI, fig. 1). The pores which dot the external surface of the tubes are smaller and less distinct than in the form just mentioned.

Spiculation. — Markedly different as is the habitus of stock from that which I have attributed to *P. farreopsis fragiferum* of Halmaheira Sea, there is a very close agreement with that subspecies as regards the spiculation. The dictyonal framework consists of beams 35—75 μ thick and weakly tubercled on surface, the tubercles being small and not very numerous (pl. XVI, fig. 20). The meshes are subtriangular or subquadrangular, mostly measuring 114—275 μ in length. The superficial nodal bosses are well developed and usually measure 100—140 μ diametrically across. However, compared with those of *P. farreopsis fragiferum*, they are on the whole considerably smaller in size, and the tubercles on them are also much smaller besides being often in an irregularly scattered distribution. The rough spikes on both dermal and gastral nodal bosses are generally slender and of a finger-like shape.

Dermal and gastral pentactins have rays 130—240 μ long. A knob in place of the atrophied distal ray is present or not present.

Scopules occur in abundance, especially abundantly on the gastral side. Their total length in specimen A 165—340 μ, mostly under 275 μ in specimen B 165—500 μ. The head-branches in both the specimens are 28—55 μ long, numbering to each spicule 3 or 4 in A and 4 or 5 in B. The branches are very slender, nearly straight or slightly bent outwards and rather weakly divergent from origin; the terminal bulb, its barbation, and the surface character of both the branch stalk (finely rough) and the shaft (sparsely rough, or for the most part nearly smooth) are quite or nearly the same as in the same spicule of the subspecies *fragiferum*. For a comparison of the dimensions it may be mentioned that in that subspecies the scopule is not shorter than 300 μ and reaches 600 μ in maximum length, the head-branches ranging 55—90 μ in length.

The discohexaster is scarcely distinguishable in its general appearance from the same of *P. farreopsis farreopsis, P. farreopsis fragiferum* or *P. semperi.* In diametre it measures 27—40 μ in specimen A, and 30—35 μ in specimen B. In the former specimen each short principal bears 4, sometimes 5, terminals; in the latter 4—6 terminals; in both cases they form a lily-like or a bell-shaped tuft. In certain cases the discohexaster may appear nearly spherical in general shape. The terminal disc is small, plano-convex and with marginal teeth, scarcely perceptible or very weakly indicated.

The uncinate is common, varying from slender and indistinctly barbed ones of 385 μ length to those about 1.5 mm. long and distinctly barbed in the usual way.

4. *Pararete farreopsis jakosalemi* n. subsp. (Plate XVII, figs. 1—7).

Stat. 97. 5°48′.7 N., 119°49′.6 E. 564 m. 3 specimens.

Diagnosis. — Stock clumpy; tubes 4—6 mm. in diametre, anastomosing at short intervals, with oscula under 2 mm. in diametre. Dictyonal skeleton small-meshed; the beams up to 110 μ thick, more or less tubercled on surface, the tuberculation being densest in the wall periphery. Superficial nodal bosses of dermal side large, up to 200 μ in diametre, not always hemispherical but frequently irregularly tuberous, beset with tubercles which are not uniformly distributed but may form dense groups of an indefinite outline or may be borne on wart-like prominences of nodal surface. Scopule with slender head-branches, uniformly diverging from origin and ending with an inconspicuous bulb of medium size (not over 6 μ in diametre).

Description. — This apparently new form, which may be regarded as a variety or subspecies of *P. farreopsis,* was obtained at Stat. 97, near Pearl Bank, Sulu Is., together with *P. farreopsis farreopsis* and *P. freeri* n. sp. Two of the specimens obtained are shown in pl. XVII, figs. 1 and 2. Both have preserved the loose spicules. The third specimen, obtained at the same spot, is fragmentary and completely water-washed.

A point of peculiarity of the subspecies seems to lie in the habitus of its stock, which at first sight appears more like being a massive body with irregular protuberances and depressions on the exterior, than like a system of anastomosing tubes. Roundish oscula of various but relatively small sizes open on top of the external protuberances and sometimes also on the sides of these. The above appearance is due to the sponge tube branching and anastomosing at so short intervals that the external spaces between the branches are only about as wide as, or narrower than, the diametre of these. As a consequence it may happen that the spaces exposed to view in damaged parts of the sponge and separated from one another by the septum-like wall, cannot be readily distinguished into the external and the gastral, without tracing them to such other parts as show their nature in an unmistakeable way.

The tubes are generally 4—6 mm. in diametre. In one specimen the wall is in most parts only about half a millimetre thick; in other specimens it is on the whole considerably thicker, being at places fully 1 mm. thick. Ocular openings with uninjured margin scarcely ever exceed 2 mm. in diametre.

Spiculation. — The dictyonal framework is rather small-meshed, the meshes being mostly considerably under 250 μ in width and variable in shape. The beams are frequently

unusually strong, the thickness ranging generally from 45 to 110 μ. They show on surface a varying number of small conical or flatly rounded tubercles. As a rule the tuberculation is most profuse on beams in the peripheral parts of the wall; in the internal parts it is sparse and irregularly scattered and at places even quite or nearly suppressed. The dictyonal nodes appear more or less swollen. Those in superficial position on both dermal and gastral sides of the wall are swollen on the outside into rough boss-like or irregularly tuberous swellings. The nodal swellings of the dermal side (pl. XVII, figs. 3—5) are very variable in size as well as in appearance. They measure mostly 110—200 μ across. Sometimes they are nearly regularly hemispherical, and at certain places a goodly number of them together may be of that shape (fig. 5), while at other times they may present a more or less indefinitely shaped tuberous appearance (figs. 3, 4) which is quite striking. This is manifestly brought about as the accretion of siliceous matter advances on the surface of originally hemispherical nodal bosses as well as on the adjoining beams and spikes. The tubercles on the surface of the swellings, regardless of these being hemispherical and boss-like or changed into a tuberous form, are by no means uniformly distributed, but occur rather in ill-defined patches of indefinite extent. Moreover, the tubercled patches are frequently raised into separate and small wart-like, otherwise low and irregular-shaped, prominences on which stand, in close grouping, a number of tubercles usually smaller than those isolatedly distributed on the general surface of the swellings. The above characterization of the superficial nodal swellings constitutes a very prominent feature of the skeleton when viewed on the dermal side, and seems to markedly differentiate the subspecies from those already described, in which the same swellings are hemispherical bosses of a more or less berry-like appearance. Somewhat the same tubercled-warty characterization of dermal nodal swellings is known to me to recur in *Pararete semperi* (F. E. Sch.) as well as in *Anomochone globosa* n. sp. and *A. verrucosa* n. sp.

The same nodal swellings exist also on the gastral side of the wall, but are generally much more weakly developed and simpler in appearance.

The spikes, representing the freely projecting end of hexactin rays which either arise from or simply pass through the superficial node they are in connection with, were not always discoverable on nodal swellings of the dermal side, probably owing to many of them having fallen off by breakage. Not infrequently the scars left by the lost spikes were distinctly demonstrable. Those spikes which remained intact were sometimes small and short, finger-like, rough processes; sometimes irregularly contoured, relatively broad and roundedly ending prominences of a varying height. Spikes of the gastral side are frequently found elongated into a spine-like shape.

In certain parts of the skeleton there is an occurrence in numbers of the usual small oxyhexactins in attachment to dictyonal beams (fig. 5).

Of the loose spicules there is scarcely a point which can be said to be peculiar to the subspecies. The dermalia and gastralia are similar pentactins with slender rays, at most about 7 μ thick at base, 150—250 μ long, faintly rough on surface, and frequently swollen a little at the end.

Scopules of both dermal and gastral sides (pl. XVII, figs. 6, 7) measure 210—340 μ in total length, of which 45—55 μ appertain to the head-branches. These, in a bunch, number commonly 4, sometimes 3 or 5. They diverge uniformly onward from origin or show an

indication of being slightly less divergent basally than in the rest of their length. Slender in their stalk-like parts, the bulbously swollen end may be 6 μ in diametre and is furnished with small, insignificant barbs. The stalks, as also the shaft, are very finely rough on surface. The general shape and size of the scopule are approximately the same as that of *Pararete carteri* (F. E. Sch.) as figured in the "Challenger" Report, pl. LXXVIII, figs. 9 and 10.

The discohexaster, which occurs rather commonly, is shaped almost exactly like the same of *P. farreopsis farreopsis* or of *P. baliense* n. sp. and *P. kangeanganum* n. sp. Diametre 30—35 μ. Usually there are 4 terminals in a lily-like perianth to each short principal.

Uncinates are of various dimensions. Some of the smaller ones met with, were only about 300 μ long and showed an obsoletely prickly surface instead of being distinctly barbed. The larger uncinates, up to 12 μ thick, are barbed in the usual manner.

Remarks. — From Stat. 95, also near Pearl Bank, Sulu Is., there is a small fragment which I am greatly inclined to identify with the subspecies *jakosalemi*. However, its completely macerated condition makes definite determination impossible.

The subspecies I have named in pleasant memory of Hon. Dionisio Jakosalem, governor of Cebu, P. I., at the time of my visit to that island in 1908—9.

5. *Pararete baliense* n. sp. (Plate XVI, figs. 7—12).

Stat. 15. 7° 2′.6 S., 115° 23′.6 E. 100 m. Several specimens.

Diagnosis. — Stock irregular clumpy, consisting of anastomosing tubes and of free branches from same; the tubes 4—10 mm. (or 3—6 mm), in diametre. Tube wall about $^2/_3$ mm. thick in most parts and not very firm, showing small pores on surface. Spiculation essentially as in *P. farreopsis farreopsis*, but differing from it in markedly diminutive dimensions of dictyonal skeletal parts and of loose spicules, except the discohexaster and the uncinate. Dictyonal framework unusually small-meshed, the meshes being generally much less than 200 μ in length; beams smooth, only 23—39 μ thick in the middle of their length; superficial nodal swellings small and rather weakly developed, 46—97 μ in diametre, sparsely tubercled, frequently more or less rudimentary; spikes generally short and small. Dermal and gastral pentactins with rays 115—154 μ long and not over 7 μ thick at base. Scopules 175—195 μ in total length; head-branches 30—42 μ long, swollen club-like at end. Discohexaster 30—35 μ in diametre, with terminals in a lily-like perianth to each short principal.

Description. — From Stat. 15, a spot to the south of Kangeang I. in Bali Sea, there are a number of well-preserved specimens representing probably more than three different stocks. On the strength of these specimens is established this new species. In pl. XVI, fig. 7, is shown the largest specimen in which the branching and anastomosing tubes are 4—10 mm. in diametre and the wall is in most places about $^2/_3$ mm. thick. The tubes form a pretty closely but quite irregularly reticulating system, giving to the stock a clumpy form. The short tube branches in the periphery open, each at the end, in an osculum of a roundish shape and about as wide as, or by expansion somewhat wider than, the tube branch it belongs to. In some other specimens the tubes are on the whole of a distinctly smaller calibre, ranging 3—6 mm. in diametre. Occasionally there exist small oscular openings on the sides of tubes, in addition to

those terminally situated and of a larger size. Sometimes, too, a part of the tubes is found opening on the outer side by an irregular elongate gap of the wall, exposing the gastral cavity in a groove-like way. Taken all in all, the general habitus of the stock greatly resembles that of *P. farreopsis farreopsis* (pl. XVI, fig. 1), though differing from this in the somewhat thinner and less rigidly firm tube wall, but especially in the much less coarsely pitted appearance of the dermal surface.

Spiculation. — The spiculation is also essentially similar to that of *P. farreopsis farreopsis*, except in the diminutive development of many spicular elements, which fact constitutes the most striking feature of the subspecies.

The dictyonal framework is remarkable small-meshed, and the bounding internodal beams correspondingly short and weak as represented in pl. XVI, fig. 8. The marked disparity in that respect from *P. farreopsis farreopsis* will at once be apparent by comparing the figure just referred to with fig. 6 (same plate), both which figures are drawn to the same scale of magnification. Meshes of a subtriangular shape seldom, if ever, exceed 175 μ in length; those of subquadrangular shape may sometimes reach a length of 220 μ. Internodal beams are generally 23—39 μ thick in the middle of their length. They are quite smooth. The nodes, more commonly multiradiate than sexradiate, appear more or less swollen, but without tuberculation between insertions of beams. Only the superficial nodes of both dermal and gastral surfaces are swollen on the outer side into tubercled and spike-bearing bosses. These are however by no means so prominently developed as in *P. farreopsis*. They measure only 46—97 μ, most frequently 50—70 μ, transversely across. The bosses are commonly not quite hemispherical, but more depressedly convex and ill-defined at base. Sometimes they may even be so very little pronounced as to be only indistinctly recognizable. The tubercles on their surface are low, rounded prominences occurring never very numerously together. The more rudimentary the swelling, the more limited is the number of tubercles borne on it. On the whole the tubercled bosses are more weakly developed and more numerously rudimentary on the gastral than on the dermal side of the wall. The spikes are generally short and small finger-like processes with minutely tubercled surface. Those of the gastral side were not infrequently met with in the form of long and whip-like processes running in an oblique direction in relation to the gastral surface.

Dermal and gastral pentactins compare well with the same of *P. farreopsis farreopsis*; only they are distinctly smaller. The paratangential rays are 115—154 μ long and not more than 7 μ thick (instead of 200—280 μ length and 9—15 μ basal thickness in *P. farreopsis farreopsis*). They are faintly rough on surface. The proximal ray is about as long as the paratangentials. A low knob is generally observable in place of the atrophied distal ray. Both dermalia and gastralia lie in indefinite relation to one another, i. e., without an attempt, so to say, on their part at forming a quadrate-meshed trelliswork with their cruciate paratangentials.

The scopules (pl. XVI, figs. 9—12) are again distinctly smaller than in *P. farreopsis farreopsis*, though similar in general appearance. They are 175—195 μ (instead of 247—343 μ) long; the head-branches generally 30—42 μ (instead of 52—72 μ) long. The branches, basally very faintly rough, are in the distal parts minutely barbed and terminally swollen more like a club than like a bulb. There are usually 3 or 4 branches in a bunch. These may run nearly parallel to one another for a short distance at base and then begin to diverge (figs. 9, 10).

More commonly they are nearly straight and divergent right from origin (fig. 11). Sometimes the divergence is but very weakly expressed (fig. 12).

The discohexaster is essentially like that of *P. farreopsis*, not only in appearance but also in size. It measures 30—35 μ in diametre. The terminals, generally 5 or 6 in number to each short principal, form a tuft like the perianth of a lily.

The uncinate is of the usual character, being provided with barbs all around the shaft. It is of a varying length. In the larger ones the thickness reaches up to 10 μ in the thickest part.

Remarks. — The above new species may possibly prove to be a form which should be ranged under *P. farreopsis* as a variety or subspecies. I leave the point to be determined after we shall have gained more experience concerning the variability of the related forms.

6. *Pararete kangeanganum* n. sp. (Plate XV, figs. 25—31).

Stat. 15. 7°2′.6 S., 115°23′.6 E. 100 m. 3 fragments.

Diagnosis. — Like *P. baliense* in habitus of stock and in the character of dictyonal skeleton, but differing from it in the abundant presence of small or medium-sized and profusely spinulated, free oxyhexactins in choanosome, and in the gastral pentactins being stronger and having paratangential rays which are set with some prominent conical tubercles on their outer and lateral sides. Superficial nodal bosses small, sparsely tubercled. Scopule shaped nearly as in *P. farreopsis farreopsis*, but much smaller. Discohexaster under 38 μ diametre, fine-rayed and delicate; terminals forming a lily-like perianth to each short principal.

Description. — From the same station as that which yielded *Pararete baliense* n. sp. (Stat. 15, south of Kangeang I., Bali Sea), there are three small fragmentary specimens, presumably representing more stocks than one, which I feel obliged to make a new distinct species. The specimens represent branching tubes 6—8 mm. in diametre, with an osculum at the end of each tube branch and with wall of $^2/_3$ mm. or thereabout in thickness. Judging from their appearance, that of the original stocks must have been similar to the *P. baliense* shown in pl. XVI, fig. 7. As in that species the wall surface is rather finely porous.

The dictyonal framework (pl. XV, fig. 31) is also of much the same character as that of *P. baliense*. The meshes are small, those of subquadrangular shape being not wider than 220 μ and those of triangular shape being still smaller. Internodal beams are smooth, measuring 23—35 μ in thickness. Superficial (both dermal and gastral) nodes are swollen on the free outer side into more or less distinct bosses, mostly measuring 65—85 μ across and beset with a sparse number of flattened-conical or rounded tubercles. It may be said that parts of the dictyonal meshwork, together with the tubercled bosses, are developed on a diminutive scale similarly as in *P. baliense*. The rough spikes, borne by the bosses, are usually moderately strong, though short. They may be 30 μ thick at base. On the gastral side of the wall they may be considerably prolonged. More than one spike frequently occur to a boss.

Here and there on the skeleton are found smooth-rayed microxyhexactins attached to the beams in the well-known manner. Apart from these, there is in all parts of the choanosome a remarkably numerous presence of free microxyhexactins (pl. XV, fig. 29). These are regularly shaped with slender and finely and moderately densely spinulated rays. The spinules stand

vertically on the rays. The spicules measure generally 45—85 μ, seldom as much as 120 μ, in the length of rays. Since they are generally much larger in dimensions than the attached smooth microxyhexactin before mentioned (fig. 31), they cannot but be regarded as spicules which will probably persistently remain free, without becoming soldered to the dictyonal skeleton.

The dermal pentactin has tapering rays, rough near the more or less pointed end and in the remaining parts very faintly so or nearly smooth. A low knob usually exists in place of the atrophied distal ray. The dimensions vary a great deal. While in the weaker dermalia the rays may be as short as 120 μ and only about 5 μ in basal thickness, the stronger ones have the rays reaching up to 220 μ long and 10 μ thick at base. The proximal ray is about as long as, or somewhat shorter than, the paratangentials.

The gastral pentactin is like the dermal in general shape and in the range of fluctuation of ray length, but differs from it remarkably in the rays frequently attaining a much thicker development (up to 20 μ basal thickness by a length of 220 μ) and in the paratangentials exhibiting a more or less pronounced tuberculation. In the smaller gastralia the paratangentials show a sparse number of small but distinct tubercles, scattered on their outer and lateral surfaces (pl. XV, fig. 26). The same tubercles grow in size with the growth of the spicule in general size and in the strength of rays; so that, in the larger and stronger-rayed gastralia they may be conical and sharply pointed, vertically standing processes of a prominent size (pl. XV, fig. 25). The processes are most strongly developed towards the base of the rays on the outer and lateral sides and also on the external surface of the spicular centre. Occasionally a process of the kind terminates with two or three conical cusp-like points. The proximal ray of gastralia is always without the above prominent development of tubercles, but is provided with small tubercles scattered all around it and most closely lying in the subterminal parts.

Scopules of the dermal and gastral sides are similar (pl. XV, figs. 27, 28). They are small and delicate, measuring generally 150—250 μ in total length and sometimes as short as 120 μ. The head is made up of 2—4 (rarely 5) branches 35—46 μ long. The slender and rough-surfaced branches run nearly parallel to one another in their basal parts, and then begin, by bending outwards, to diverge distally in varying degrees, similarly as in *P. farreopsis farreopsis*. Terminally each branch gradually thickens into a club-like or elongate-knob-like shape, which parts show small but distinct barbs.

The discohexaster (pl. XV, fig. 30) is scarce, though at places several may occur together. It is small, measuring 23—38 μ (mostly under 30 μ) in diametre. The rays are unusually fine, there occurring commonly a lily-like perianth of 4 or 5 terminals to each short principal.

Uncinates of various sizes are fairly common. While the larger ones are greatly in excess of 1 mm. in length and 8 μ or over in thickness, others are much shorter and finer, leading down to those of only 165 μ length and rhaphidial thickness, in which the barbs have quite or nearly disappeared.

7. *Pararete freeri* n. sp. (Plate XVII, figs. 8—23).

Stat. 90. 1° 17′.5 N., 118° 53′ E. 281 m. 1 fragment.
Stat. 95. 5° 43′.5 N., 119° 40′ E. 522 m. 1 specimen and fragments.
Stat. 97. 5° 48′.7 N., 119° 49′.6 E. 564 m. 1 specimen and fragments.
Stat. 100. 6° 11′ N., 120° 37′.5 E. 450 m. Fragments.

Diagnosis. — Stock clumpy, consisting of moderately thick-walled anastomosing tubes 6—8 mm. in diametre, with interspaces about as wide between them. Dictyonal skeleton made up of beams moderately strong, smooth or sparsely and not uniformly tubercled; dermal nodal bosses moderately well developed, scatteredly tubercled on surface, bearing relatively thick finger-like spikes. Free microxyhexactins not uncommon. Dermalia with faintly rough rays 135—174 μ long; gastralia similar, the larger ones with a sparse number of vertical conical spines on outer and lateral sides of paratangentials. Characteristic are the scopules, both dermal and gastral, in which the head-branches vary from being slender, outwardly bent at about the middle and bulbously swollen at end to being relatively short, nearly straight, little divergent and so broadly inflated in the distal half of their length that the entire branch presents a spathulate outline (27 μ long and 10 μ thick in the thickest part); minutely barbed in the bulbous parts. Discohexaster 30—46 μ in diametre, the delicate terminals forming a lily-like perianth to each short principal.

Description. — The species is based on the well-preserved specimen shown in pl. XVII, fig. 8, which specimen represents but a segment broken off from a stock at the time of its capture. It was taken at Stat. 97, near Pearl Bank, Sulu Is., together with *P. farreopsis farreopsis*, *P. farreopsis jakosalemi*, etc.

The specimen consists of thick-walled and rigid anastomosing tubes 6—8 mm. in diametre. The interspaces between the tubes are about as wide as these, so that the tube reticulum is a pretty close-meshed one. The roundish oscula which open at intervals of 6—11 mm., each surrounded by a protruding marginal wall, are 5—7 mm. in diametre. The tube wall is on the average about 1 mm. thick. It presents on the surface a densely granular or finely porous appearance. A number of a small commensal Anthozoa are attached to the dermal surface as well as to a part of the gastral.

Spiculation. — The dictyonal framework is rather small-meshed, the meshes generally not exceeding 200 μ in width. The beams are moderately strong, up to 60 μ thick. Those in the middle parts of the thickness of the wall are smooth, while those more superficially situated on either the dermal or the gastral side generally show a sparse number of small tubercles in an irregular, not uniform, distribution. Dermal nodal bosses are medium-sized, not over 130 μ across, and studded with a rather sparse number of low rounded tubercles. The spike, of which there are usually one and sometimes two to a boss, is commonly short and thick, densely tubercled towards the rounded end. It may be said that the dictyonal skeleton is, in its characters, scarcely distinguishable from that of *Pararete semperi* (F. E. Sch.) as described by F. E. Schulze in the "Challenger" Report. — Ankylosed microxyhexactins were not met with, though probably not altogether absent. On the other hand, there is a not uncommon occurrence of free oxyhexactins with slender rough rays 38—65 μ long.

The dermal pentactin is of the usual appearance, the faintly rough rays measuring 135—174 μ long and 6—10 μ thick at base (pl. XVII, fig. 11). — The gastral pentactin is similar to the dermal, or is somewhat more strongly developed, the paratangentials being generally tapering to end and showing a few distinct vertical spinules on their outer and lateral sides (pl. XVII, fig. 10). This reminds one of the gastralia of *P. kangeanganum*, but the rays as also the spinules are here of a very much weaker development.

The scopule, irrespective of its position on either side of the wall, may measure 200—280 μ in total length. The head-branches may be 42—27 μ long; the shaft 5 μ thick. The most striking feature of the species is offered by many, though not all, of the scopules, both dermal and gastral, in having the head-branches, which commonly number 4—2 to a spicule, relatively short, but little divergent and distally bulbously swollen to such an unusual extent that their outer half may present a spathulate or even a balloon-like outline (pl. XVII, figs. 13—15). The bulbous end may reach 10 μ in transverse diametre by 27 μ length of the entire branch. It is smooth on the rounded top and minutely barbed on the sides. In addition to this peculiar form of the scopule there occurs, especially frequently on the gastral side, another form of more ordinary appearance (figs. 17, 18) in which the much more slender and smaller-bulbed head-branches with more distinctly barbed bulbous parts are outwardly bent at about the middle of their length. However, the two forms of scopule merge into each other by gradations; intermediate forms, such as the one shown in pl. XVII, fig. 16, are of frequent occurrence on either side of the wall.

Discohexaster of 30—46 μ diametre occurs commonly (pl. XVII, fig. 12). Its general appearance is similar to that of most other species of the genus. In the larger of the rosette there are 10—6 terminals in a perianth, in the smaller only 5 or 4. The principals are short, sometimes moderately long.

Uncinates of various sizes are present. Rhaphidial needles of 140 μ length, met with in some number, are without doubt the smallest uncinate in which the barbs have disappeared.

Other specimens. — Two small fragments from the same station as the above, bearing remains of a branching Hydrozoan colony in the wall, seemed referable to this species in spite of certain deviations in spiculation from the type. The more noteworthy points in those fragments are as follows: The dermal nodal swellings are larger (up to 140 μ across) than in the type, sometimes somewhat tuberous, and are beset with unequal tubercles in irregular distribution, the smaller tubercles often forming small groups by themselves or being borne on small, wart-like prominences. In this character of the nodal bosses the specimens in question seem to approach *P. farreopsis jakosalemi* and also *P. semperi* (F. E. Sch.). The scopules are of a widely varying appearance (pl. XVII, figs. 19—23). While exhibiting a close, but not complete, agreement in their shape with the same of typical *P. freeri* (figs. 13—18), the head-branches are frequently quite or nearly smooth all over (figs. 20—22). Sometimes the smooth branches are swollen to only the extent of giving them a slenderly club-like shape as shown in pl. XVII, fig. 21, in which case the spicule appears closely similar to the dermal scopule of *P. semperi* (pl. XVI, figs. 27—29). The gastral pentactins are without macrotubercles on the paratangentials, which are simply faintly rough like the corresponding rays of the dermal pentactin. The discohexaster, 30—46 μ in diametre, is quite numerous on the gastral side of the wall. It is frequently nearly spherical in general shape, although each group of terminals still preserves to a certain extent the usual perianth-like appearance. In most cases the terminals are about as strong as in *P. farreopsis farreopsis*.

Further from Stations 95 and 100, both spots not very far distant from the locality of the type specimen, there are some more or less fragmentary and completely macerated specimens which I am inclined to ascribe to the present species from the agreement in the characters of

the dictyonal skeleton. The same may be said of a small fragment from Stat. 90, on the eastern coast of Borneo.

Remark. — The species I have named in memory of the late Dr. P. C. Freer, the erstwhile director of the Bureau of Science in Manila.

8. *Pararete semperi* (F. E. Schulze). (Plate XVI, figs. 22—29).

Eurete semperi F. E. Sch., 1886, p. 70; 1887, pp. 292, 392, pl. LXXVII.

Stat. 251. 5°28′.4 S., 132°0′.2 E. 204 m. 1 specimen.

Diagnosis. — Stock clumpy, consisting of irregular, thick-walled, anastomosing tubes which at places may reach 15 mm. but are more commonly 5—8 mm. in diametre; wall with distinct shallow pits on external surface. Dictyonal skeleton made up of moderately strong, more or less tubercled beams; dermal nodal bosses up to 140 μ across, frequently somewhat tuberous, with tubercles not uniformly distributed; gastral nodal bosses more weakly developed. Dermal pentactin with subterminally rough rays; gastral pentactin similar. Dermal scopule (330—440 μ long) with slightly divergent head-branches 39—60 μ long, swollen spindle-like in the distal half of their length (F. E. Sch.) or slenderly club-like and thickest at end, straight or slightly bent, smooth all over or with a limited number of minute tubercles on the rounded end. Gastral scopule with slender head-branches, geniculate near base and terminating with minutely barbed and bulbously swollen end; in part of the same form as the dermal scopule. Discohexaster quite or nearly as in *P. farreopsis farreopsis*.

Description. — The type specimen of the species described by F. E. Schulze was obtained by the "Challenger" near Little Kei I. from a depth of 140 fathoms. The "Siboga" obtained in the same region, at her Stat. 251 (South of Kur I., Kei Is.), the moderately large and well-preserved specimen shown in pl. XVI, fig. 22, which seems referable to the same species, notwithstanding certain small differences from F. E. Schulze's description of the type. The stock is of a nearly hemispherical clumpy appearance, consisting of rather crowdedly branching and anastomosing tubes about as wide as the interspaces between them. It seems to have been attached to the substratum at one part by a broad basal plate in a nearly sessile way and besides by two or three small, independent pedestals. The tubes are 5—8 mm. wide. The rigidly firm wall is thick, measuring in most places fully 1.5 mm., in certain places even 2 mm., in thickness. The oscula vary considerably both in size and shape. The smaller oscula, 1—3 mm. in diametre, are roundish and usually appear to occur on the side of tubes, each surrounded by a more or less raised margin; the larger ones, which may measure 3—6 mm. across, are of a lobate or an irregularly elongate outline, generally situated at the peripheral end of short branches. It seems that new formation of oscula or of branches does not always take place in a strictly dichotomous way. The dermal surface is distinctly marked with numerous shallow pits or epirhytic recesses up to half a millimetre across. The recesses give to the surface a pock-marked-like appearance or that of its being raised into reticulating ridges. This probably constitutes one of the most pronounced distinctive features of the species. The gastral surface is of a more even-like appearance than the dermal.

Spiculation. — The dictyonal framework consists of beams up to 75 μ thick. Those

in the periphery of the wall are rather densely and uniformly tubercled (pl. XVI, fig. 23), while those in the deeper parts are more sparsely, or more faintly, and at times scarcely at all, tubercled (fig. 24). The meshes, usually subtriangular in shape, are relatively small in the peripheral parts, generally measuring under 165 μ in length of the longest side. They are on the whole larger in the deeper parts of the wall. The dictyonal nodes are of a more or less swollen appearance; they are ordinarily smooth between beam insertions, or may occasionally show a few such small tubercles as occur on the beams themselves. It is however another matter with the spike-bearing and constantly tubercled bosses which are developed on the outer side of each and every superficial node on dermal and gastral surfaces of the skeletal wall. F. E. Schulze, in his figure of a transverse section of the wall of *P. semperi* (Chall. Rep., pl. LXXVII, fig. 2), has represented all the dictyonal nodes in the entire wall thickness to be tubercled in a peculiar way around the base of certain beams that join them. The correctness of that representation is exceedingly doubtful, as is also that of the similar state depicted by the same author for *Eurete schmidti* (Chall. Rep., pl. LXXVIII. fig. 2). The hemispherical nodal bosses (pl. XVI, fig. 23) of the dermal side are moderately large, commonly measuring 100—140 μ in diametre. They may sometimes be of a tuberous form instead of being regularly hemispherical. The tubercles on their surface are about as small as those on the adjoining beams, and are found in an irregular distribution, thus making the bosses resemble somewhat the same of *P. farreopsis jakosalmi*. The rough spikes on dermal bosses are either thick and stump-like or small and thin. Nodal bosses of the gastral side (pl. XVI, fig. 24) are, in comparison with the same of the dermal side, on the whole slightly smaller and more sparsely but somewhat more coarsely tubercled. The rough spikes on them are slenderly elongate processes.

F. E. Schulze has mentioned from the type specimen small microspiny oxyhexactins found free in extraordinary abundance in the parenchyma. Such loose oxyhexactins have not come under my notice, though those which are connected to the dictyonal beams in the usual way were found in fair abundance in certain parts of the skeleton. The fixed pedestal-like ray in those microxyhexactins is always smooth and may be 80 μ long, while the remaining rays vary from being distinctly microspiny to nearly smooth, and seldom reach over 45 μ in length.

The dermal pentactin has rays 150—230 μ long, up to 7 μ thick at base, rough in the terminal parts but nearly smooth or very faintly rough in the remaining parts, and rounded at end. A swelling in place of the atrophied distal ray, does not exist. The gastral pentactin is similar to the dermal.

The dermal scopule (pl. XVI, figs. 27—29), 330—440 μ in total length and with head-branches 39—60 μ long, occurs in great abundance and presents some peculiar points. The head-branches, of which 3 or 4 (occasionally 2 or 5) occur in a weakly divergent bunch, are slenderly club-like and thickest at the outer end. They are straight or but slightly bent, and either perfectly smooth all over or provided sometimes with a single minute apical tooth, at other times with a few number of obsolete tubercles — not barbs — scattered apparently without a rule on the rounded distal end. That end of the branch in profile view presents an outline which is frequently not symmetrically rounded, but slightly angular on the inner side, thus bringing about an outline somewhat like that of the tip of a table-knife blade. The thickened branch end, not thicker than about 6 μ, passes over imperceptibly into the inferior parts. The

above dermal scopule differs not inconsiderably in the details of character from the description and figures given by F. E. Schulze from the type specimen. According to him the branches have a smooth spindle-shaped thickening near their end, which occasionally exhibits a somewhat sharply pointed tip and an inwardly directed sharp edge. For the present I am inclined to regard the difference in this respect between the specimens as probably not running beyond the limit of variation within the species, especially as there seems to exist between them a far-reaching agreement in all other respects.

The gastral scopule is shorter than the dermal, measuring 216—275 μ in total length and 45—54 μ in the length of head-branches. In appearance it is in part like the dermal scopule and in part of the form shown in pl. XVI, fig. 26, in which the branches, consisting each of a slender stalk and a minutely but distinctly barbed, bulbous terminal swelling, are gently geniculate a short distance from their origin, somewhat as in *P. farreopsis farreopsis*. Intermediate transitional forms seem to exist between the above two kinds of gastral scopules. F. E. Schulze seems to have found in the type specimen only the kind with barbed bulbous end to branches of the gastral scopule.

The discohexaster, 35—43 μ in diametre, occurs in abundance. The rays are rather strong. There are usually 3—5 (in a case 7) terminals, each gently curved in an **S**-like manner and all together forming a perianth-like tuft at the end of each short principal (pl. XVI, fig. 25). They are tipped each with a minute disc indistinctly toothed on margin. The appearance of the hexaster is essentially the same as that of *P. farreopsis farreopsis*.

Uncinates of the usual character and of varying dimensions up to those 8 μ thick are common. They are occasionally found forming loose bundles.

Remarks. — The scopule with smooth, slenderly clavate head-branches, such as is shown in pl. XVI, fig. 29, is quite similar in appearance to that which seems to occur occasionally in certain individuals of *P. freeri* n. sp. (cfr. pl. XVII, fig. 21). This may be taken for an indication of an especially close relationship between that species and the present.

Indeterminable Eurete or Pararete.

There exists in the "Siboga" collection a number of small fragmentary specimens, probably referrible to either *Eurete* or *Pararete*, but which cannot be definitely identified, nor can be usefully described, on account of their being in a completely water-washed or otherwise imperfect state. I therefore limit myself to mentioning that there are such specimens from Stations 12, 59, 94, 95, 97, 105, 156, 159, 251, 254, 259, 262, 266 and 267.

Genus **Pleurochorium** Schrammen, 1910—12.

Eurete Kirkpatrick, 1908, pp. 21—24.
Pleurochorium Schrammen, 1910—12, p. 251.

Euretids tubular, erect, with lateral oscula situated in opposite pairs or in a subspiral disposition around the tube and forming two or four longitudinal series on it; parts of the margin of each lateral osculum developed into a lamellar branch-like appendage explanate at right angles to the axis of the tube. Same appendages in relation to each opposite pair of lateral

oscula may become confluent with their sides, so as to form a broad hat-rim-like band that completely encircles the tube. With small discohexaster so far as known.

Genus *Pleurochorium* was first instituted by SCHRAMMEN (l. c.) for a single fossil species, *P. schulzei* Schram., of the most remarkable characterization from the Upper Cretaceous of north-western Germany. I quote the following from his description of that species:

"Der Schwammkörper besteht aus einer dünnen und dünnwandigen, seitlich ziemlich stark zusammengedrückten kurzgestielten Röhre, von der in kurzen regelmässigen Abständen breite, aber papierdünne, düten- oder weittrichterförmige Flügel ausstrahlen, die übrigens nur mit äusserster Vorsicht unbeschädigt in situ zu erhalten sind. Von der Seite gesehen gleichen die übereinander liegenden Flügel ineinander steckenden Düten, deren spitze Enden nach der Basis des Schwammes zeigen. Dicht unter jedem Flügelansatz wird der röhrenförmige Teil des Schwammkörpers an den beiden Schmalseiten von grossen rundlichen oder U-förmigen Wandlücken durchbrochen", ... "Das Skelett ist sehr dicht und engmaschig und besteht an der Röhre aus unregelmässig orientirten Diktyonalhexaktinen mit dornigen Strahlen. In den Flügeln verschmelzen die Hexaktine zu vorwiegend longitudinalen, radialen und zirkulären Balkenzügen. Über die innere Oberfläche der Flügel legt sich ein lockeres Deckgespinst, das aus beliebig orientirten Hexaktinen mit im Verhältniss zur Länge auffällig dünnen dornigen Strahlen zusammengesetzt ist".

Nothing is known of the loose spicules, as might be expected. The cornet-like or hat-rim-like appendages in serial succession, one above another around the stem-tube, constitute the most striking and characteristic feature of the species. They are excellently shown by the specimens represented in SCHRAMMEN's (1910—12) pl. XXVII, figs. 3 and 4. Judging from the knowledge derived from other forms most nearly related to, and probably generically identical with, that species, there can scarcely be a doubt that those remarkable appendages are hypertrophic productions from a part or parts of the marginal wall to lateral oscula on the stem tube. In one of the figures given by SCHRAMMEN of the species (his pl. XXVII, fig. 5), which shows an example with the cornet-like appendages broken off, most of the lateral oscula are seen to have the margin produced into a wing-like pair of small pointed processes, each situated on their either lateral side. In a personal correspondence the author has assured me of the fact that, as regards that particular specimen, the fragile appendages had fallen off during the process of preparation. The above paired marginal processes to lateral oscula are then clearly vestiges of the appendages, left behind presumably because of the parts being relatively strongly structured and standing in firm connection with the tube-wall, while their more delicately constructed parts have broken off. I regard the paired processes in question, together with the similar processes I have found in *Pleurochorium cornutum* n. sp., to represent the basic or earliest formed parts of the explanate lamellar appendage peculiar to the genus.

Previous to the appearance of SCHRAMMEN's description of *Pleurochorium*, KIRKPATRICK (1908) has described his *Eurete annandalei* from off the coasts of Ceylon. That species I should range under *Pleurochorium* Schram. We have here again to do with an erect tubular form provided with peculiar lamellar appendages which only differ considerably from those of *P. schulzei* in the details of development. The lateral oscula occur on the stem tube in opposite pairs and at the same time disposed in four longitudinal series. The appendages, developing invariably in connection with each lateral osculum, stand out separately like horizontally explanate branches

or obcordate leaves; the two, belonging to an opposite pair of lateral oscula, do not unite into a ring around the stem tube, as they seem to do in *P. schulzei*. From the condition described of the appendages it can be assumed that these arise each in a way somewhat as follows: First the oscular margin is produced into a pair of processes, one on each lateral side of the oscular opening; the two processes then join with their ends so as to form a narrow arched bridge over the oscular opening, a process essentially the same as that which sets in at the initial stage of the ordinary division of a Farreid or an Euretid osculum into two daughter oscula; and finally that bridge grows out, crest-like, into the horizontal lamellar appendage in question. The original lateral osculum may now be said to open externally, at the base of the appendage, by two daughter oscula or secondary orifices, one opening on its upper and the other on its lower surface. The upper secondary orifice, it is said, may sometimes close up, in which case the osculum comes to open externally solely by the persistent lower orifice. Apparently just this mode of opening of lateral oscula seem to have obtained in SCHRAMMEN's examples of *P. schulzei*, in which an opposite pair of lateral oscula should exist close under every cornet-like expansion of the tube wall. In *P. annandalei* (Kirkp.) the leaf-like appendages do not always come off at once from the stem tube but frequently at the end of a short, subcylindrical, hollow stalk. This, I think, is due simply to the margin of the lateral osculum having grown out into a short branch tube before it sets about in the formation of the leaf-like expansion in the manner indicated above.

The dictyonal network of *P. annandalei* was given by the describer as made up, below the surface, of square or oblong meshes, and on the surface, of triangular meshes. Free microxyhexactins present, with finely spined surface. Dermalia and gastralia not observed. Scopules in two kinds: one 436 μ in total length and with 62 μ long head-branches ending with barbed pyriform knob; the other 694 μ in total length, with smooth, slenderly lanceolate, 82 μ long head-branches without terminal knob. Discohexaster small, 44.5 μ in diametre, with rough terminals in a bell-shaped tuft to each short principal; in general appearance similar to the discohexaster of most *Pararete* species.

Finally, the "Siboga" has obtained a third species of the genus, which will directly be described under the name of *P. cornutum* n. sp.

As regards the systematic position of *Pleurochorium*, there can be no doubt of its being an Euretid of closest affinity to *Pararete*. From spiculation alone it can scarcely be distinguished from that genus. But, in view of its high specialization in macroscopic characters, and moreover, since there exist several specifically distinguishable forms under it, I think it advantageous for the system to retain *Pleurochorium* as a genus separate from *Pararete*.

SCHRAMMEN has associated *Pleurochorium* with another fossil genus *Pleurothyris* in a distinct family, the Pleurothyrisidae, among his Hexactinosa incertae sedis. In the characterization given by him of the latter genus, I fail to discover any point which might be taken for a sure indication of its specially close relationship to the former.

1. *Pleurochorium cornutum* n. sp. (Plate XVII, figs. 24—34). Textfig. 23.

Stat. 297. 10° 39′ S., 123° 40′ E. 520 m. 2 specimens and 1 fragment.

Diagnosis. — Tubular, presumably erect standing. Lateral oscula not in opposite pairs,

arranged in four longitudinal series on tube; many of them with the margin produced in the lateral parts into a pair of divergent wing-like processes, which probably represent basic parts of a horizontally explanate, flabellate, lateral appendage in connection with each lateral osculum. Dictyonal framework rectangular-meshed with admixture of subquadrate and triangular meshes; beams sparsely microtubercled, in part forming long longitudinal fibres. Dermal and gastral pentactins with weakly rough rays. Commonest form of scopule, both dermal and gastral, 300—400 μ in total length, with head-branches 80—108 μ long or longer, usually 3 together in a bunch, nearly parallel at base, distally widely divergent, slender but thickened at end and finally capped with a watchglass-like, marginally distinctly serrate disc which may reach 17 μ or more in diametre. As gastral scopule there is an occasional occurrence of a more slender scopule with 5 or 6, shorter head-branches ending with a relatively small bulb provided with a circle of tooth-like barbs. Small discohexaster of 20—46 μ diametre present in certain parts in fair abundance, each short principal bearing 2 or 3, strongly divergent terminals ending with a small pinhead-like swelling.

Description. — This new species is established mainly on the basis of two small, unfortunately incomplete specimens which were obtained at Stat. 297, a spot off the southwestern extremity of Timor. At the same station was also obtained a remarkable fragment which I regard to be a lateral appendage broken off from a large individual of the same species. They will be specially noted after I shall have done with the description of the first mentioned two specimens.

Both these are shown in pl. XVII, fig. 24. They represent a short (approximately 20 mm. long) and somewhat irregular-shaped tube, roundish in cross-section and of a varying thickness in different parts, though narrowest at the inferior broken off end where the diametre is 3—4 mm. The other end shows in both the specimens the terminal osculum of 3.5—5 mm. diametre, surrounded by a naturally preserved, slightly expanding simple rim. What fraction of the original stock the specimens represent, cannot be exactly determined; however, from the condition of the narrowed inferior end it may be assumed that the breaking off occurred at a point not very far distant from the sponge base.

The rigid but delicate tube wall is 0.5 mm. or less thick. It opens on the sides in roundish lateral oscula, numbering six or seven in all to each specimen and measuring not more than 2 mm. in diametre. These are distributed on four sides of the tubular body, and as regards those situated on opposite sides, in an alternate disposition or at any rate, not in exactly opposite pairs. At each lateral osculum the margin is raised more or less like a lip, but never to the extent of deserving the name of branch tube; and moreover, in many of the oscula the rim is produced, at its two lateral and nearly opposite parts, into paired processes of a varying height. In some cases the processes are merely indicated; in other cases they form rather conspicuous parts that give a characteristic feature to the specimens, projecting divergently and slightly obliquely upwardly directed like pairs of little horns or wings. They are generally plate-like by lateral compression, broadest base, up to about 3 mm. high, and abruptly truncate at the narrowed end as if broken off. As a matter of fact, close examination of the skeleton at the end of the processes reveals a fractured condition. Evidently the processes in question are stumps, left behind after the breaking off of certain portions at their end. In a case of the oscula there

exists, instead of a pair of processes, a single projection formed by prolongation of the margin at its upper parts. The general appearance of the paired processes at once reminds one very forcibly of the similarly situated processes visible in the figure given by SCHRAMMEN (1910—12, pl. XXVII, fig. 5) of a specimen of *Pleurochorium schulzei* from which the cornet-like lamellar appendages had fallen off. As given before (p. 196), those processes I regard to represent the origin point of the appendages just referred to but lost in that particular specimen. Exactly the same significance I should attach to the marginal paired processes of the specimens under consideration of *P. cornutum*. I shall return to this point again in the account of the fan-shaped lamellar fragment obtained at the same station and which I regard to be nothing else than an external appendage detached from an individual of the species.

Spiculation. — The dictyonal framework is made up of fairly parallel, longitudinal beams which can be traced as uninterruptedly running fibres of a great length, and of much more irregularly disposed, short, connecting beams (pl. XVII, fig. 28). The beams are thin, being generally 16—38 μ thick. They are sparsely besprinkled on surface with minute conical tubercles. The nodes of intersection of the beams are not swollen; nor are the superficial nodes swollen into the external bosses. Densely tubercled spikes of the dermal side are finger-like or slenderly conical with rounded end, not exceeding 100 μ in length. Those of the gastral side are generally longer. The dictyonal meshes are mostly quadrangular and frequently elongate in the longitudinal direction; occasionally they are triangular. A large mesh may reach 300 μ in length by a width of 100—200 μ. There may exist two, three or more meshes in the thickness of the wall at different points.

With regard to the loose spicules, I have had in certain cases to excercise caution in discriminating between those which really belonged to the specimens and others which were extrinsic intrusions. In many slide preparations it was not uncommon to come across spicules which could without heed be identified with those of *Farrea occa mammillata*, a form obtained in the same haul of the trawl.

The dermal surface of both the specimens has been nearly completely denuded of the covering spicules. Only here and there on that surface I have met with medium-sized pentactins, which, from the manner of their occurrence, can safely be regarded to be the dermalia of the species. The paratangential rays are 110—165 μ long and nearly straight or slightly arched in side view; the unpaired proximal ray is usually slightly shorter than paratangentials of the same pentactin. All the rays are weakly rough on surface and not over 6 μ in thickness. A knob in place of the distal ray does not exist. — The gastralia are quite similar to the dermalia. They occur in scattered distribution. — It may be pointed out that both the dermalia and gastralia scarcely differ in appearance from certain examples of the same spicules of *Farrea occa mammillata*, referred to above as the source of some spicules which have intruded into the specimens. I have therefore been careful to select for basis of the above description of the covering spicules only those pentactins which lay in the natural undisturbed state, standing in direct relation to subjacent tissues with their unpaired ray.

The commonest scopule, found on both dermal and gastral sides of the wall, is striking on account of its large size and the watchglass-like development of the tip of head-branches (pl. XVII, fig. 25). It commonly measures in total length 300—340 μ, occasionally reaching down

to 220 μ. The head-branches are 80—108 μ long, being generally equal to $^1/_4$—$^1/_3$ the entire length of the spicule they belong to. The shaft, which is for the most part of its length about 3 μ (anyway not over 4 μ) thick, is perfectly smooth except near its obtusely pointed inner end, in which part it is slightly swollen and may show some weak tubercles on surface. The head consists of branches usually 3, exceptionally 2 or 4, in number. These are basally very slender, and after arising from a small swelling at the outer end of shaft, proceed nearly parallel and very close together for a short distance and then begin to diverge from one another, each taking after that a straight or nearly straight course. In this part of their length the branches are finely rough on surface. Distally they commence to thicken, at first very gradually, but finally expanding into a trumpet-like shape at the junction with the convex and watchglass-like terminal disc. They may measure 4 or 5 μ, sometimes nearly 7 μ, across at this end. The terminal disc may be 12—17 μ in diametre; its margin is dentated, the moderately strong marginal teeth numbering 14—19 in all. Thus, the branch end is of a characterization very similar to the head of the pileate clavule of a Farreid, but quite unusual for the tip of scopule branches. Rarely in both the specimens I have met with scopules essentially like the above in all respects but excepting the fact that the head-branches remained very slender, right on to the tip which formed a small subtruncate simple knob without an indication of marginal teeth. The scopules I am inclined to take for adolescent ones in which the disked terminal parts of the branches are not yet fully developed.

On the gastral side of the wall there were occasionally found, together with the above described form of scopule, another kind which differed from it markedly in some respects (pl. XVII, fig. 26). This second scopule form measures 230—385 μ long. Compared with the first form, the shaft is more slender and the branches are much shorter, measuring only 50—65 μ long, and occur more numerously together at a time (5 or 6 in number), running divergently at once from origin. Moreover, the branches end each with a relatively small bulbous swelling only 4—7 μ across, which is encircled by a whorl of small retrocedent teeth. In fact, the top of the terminal swelling is not disked but remains a hemispherical knob.

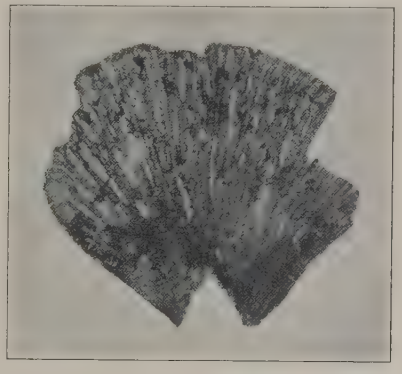
The discohexaster (pl. XVII, fig. 27) was met with in fair abundance on the gastral side of the wall. It is very small, measuring 20—40 μ, seldom 46 μ in diametre. Each short principal bears 2 or 3, straight or but slightly bent, moderately strong and divergent terminals ending with a small pinhead-like disc. Oxyhexasters occasionally found in the preparations, I consider to be nothing else than intrusions from *Farrea occa mammillata*.

Uncinates of the usual appearance, with low lying barbs, exist in some number. A large one measured over 1.5 mm. long and 14 μ thick in the thickest parts. A small one was 600 μ long and about 4 μ thick.

The fan-shaped fragment from the same station (pl. XVII, figs. 29—34, textfig. 23). The fragment, before alluded to as probably representing a detached lateral appendage of *Pleurochorium cornutum*, is the one shown in pl. XVII, fig. 29 in natural size, and also in textfig. 23, this time twice magnified and on a different background. It is a thin flat plate of a broadly obovate fan-like shape, appearing not unlike a little Gorgonid stock. The somewhat narrowed end which presents an indented fractured edge may be referred to as the base. Length from basal end to opposite convex margin 22 mm.; transverse length 26 mm.

The plate is thickest at the ends of the projections on either side of the indented base, at which points it is nearly 2 mm. thick. Thence outwardly it soon thins and remains nearly uniformly thin in its major part. Close to the obtuse-angled edge, opposite the base, the thickness is not greater than $^1/_8$ mm. The margins have suffered some damages, but the loss of parts caused thereby may safely be said to have been not considerable. The lower parts of the lateral edges converging towards the fractured base give an impression of their being nearly in the natural state. After all, the fragment seems to represent nearly the entirety of a sponge part severed off at its base from a certain other part. The tips of the base show no sign of the condensation of skeletal tissues which they might have shown if the severing off took place close to the point of attachment to a foreign object.

Manifestly the fragment was living at the time it was obtained. It has preserved the loose spicules, and with them the soft parts also. The individual chambers are scarcely recognizable as such, but there distinctly remain what can be taken for the chamber-bearing tubes or tubular outbulgings of the chamber layer (textfig. 23). The tubes run in the skeletal meshes, on the whole radially from the base towards the opposite rounded edge, alongside of one another in a layer and dividing and anastomosing in their course. The tubes became more clearly visible after partial desiccation of the specimen than before when it was wet. This was probably due to the condensing, in or about their wall of a mucous-like substance of unknown origin, with which the specimen was found imbued. The tubes run close together in the basal parts; in the peripheral parts they leave between them elongate interspaces which show generally 2 or 3 empty dictyonal meshes in their width. They end blind at their outer ends. In my view, the arrangement of the said tubes marks the two opposite faces of the specimen as dermal. The water should have entered the sponge from both those surfaces, and after passing through the chambers, must have streamed in the tubes directed towards the fractured base.



Textfig. 23. — Probably a flabellate lateral appendage broken off from a large stock of *Pleurochorium cornutum* n. sp. × 2. Showing branching and anastomosing chamber-bearing tubes in the dictyonal meshwork.

The delicately structured dictyonal framework (pl. XVII, fig. 34) shows, in the first place, numerous radial beams running as long continuous fibres from the base to the rounded margin. The fibres run on an average 200 μ apart from one another. They occur in several layers in the thickened basal parts, there reaching up to 50 μ in thickness; whereas, in the peripheral parts they are found in not more than two layers and are only 15—30 μ thick. The cross-beams, connecting the radial beams laterally as well as vertically, are much less regular in arrangement, being often more or less obliquely directed in relation to the latter. They often come into abrupt termination on junction with the radial beams (false nodes). Thus, the cross-beams do not form distinct transverse and vertical systems as against the longitudinal system of beams. What results from the union of all the beams is a meshwork, which, though exhibiting at places an approach towards being regularly quadrate- or rectangular-meshed contains a plenty of round-cornered triangular or trapezoidal meshes of varying dimensions, almost precisely as in

the wall of the tubular specimens before described. Three-dimensional mesh-spaces are arranged generally in a single layer in most parts of the plate-like piece, and in several layers at the end of the two thickened basal projections. The beams are generally smooth; only those in the basal parts of the fragment are sparsely microtubercled.

Coarsely tuberculated harrow-teeth-like spikes occur in a similar way on both sides of the dictyonal layer. The spikes stand out erect, may be 150 μ long, and are obtusely pointed at end.

Isolated cases of microxyhexactins, ankylosed to the dictyonal beams, were met with in the basal parts of the specimen. In most other parts they seemed not to occur.

With respect to the loose spicules, the state of preservation of the specimen again prevented the acquirement of a complete knowledge about them. The superficial covering spicules have been nearly all dislodged from their natural position. Not a small number of the pentactins found sticking to the surfaces, I take no heed in declaring to be spicules foreign to the specimen, — in fact, to be the dermalia or gastralia derived from *Farrea occa mammillata* obtained in the same haul of the trawl. On the other hand, certain other pentactins in the same situation could with confidence be regarded to be the dermalia proper to the specimen, though they differed but little in appearance from the extrinsic pentactins above referred to. That conclusion was arrived at from certain circumstances of the occurrence of those pentactins, but especially from the fact that they were frequently found in intimate association with the characteristic scopule of the specimen, being exactly so oriented in relation to this as we should expect them to be if both the spicules belonged to the specimen and occurred together on the same side of body. The pentactin in question (pl. XVII, fig. 33) has rays 124—155 μ long, about 7 μ thick, rounded at end and rough on surface owing to microtuberculation. The paired rays are slightly curved so as to be concave on the inner side. A low prominence in place of the atrophied sixth ray may be or may not be present.

The scopule (pl. XVII, figs. 30—32) occurs in moderate abundance in all parts and equally on both sides of the specimen, generally isolated but sometimes several together in bunches. In appearance it closely agrees with the common scopule kind before described from the type specimens of the species. What slight differences there exist from the latter, consist in the terminal branches being somewhat more thickly swollen in the terminal parts and capped with a slightly larger disc at the very end. The scopule measures 270—350 μ in total length. The shaft, about 4 μ thick, is smooth or nearly smooth except on the gently club-like subterminal swelling at its inner end, which swelling shows a sparse but distinct microtuberculation. The outer end exhibits a small smooth swelling whence arise the head-branches. These number 2 or 3 at a time and measure 77—129 μ in length, making up $^1/_4$—$^1/_3$, sometimes nearly but not quite $^1/_2$, of the entire spicular length. They are basally very slender and smooth. For some distance after their origin they run parallel to one another and close together; then they diverge from one another and soon commence to gradually increase in thickness, reaching up to about 12 μ thickness at the junction with the convex watchglass-like terminal disc. The thickened parts are nearly smooth or finely rough. The terminal disc is 19—23 μ in diametre; its margin is dentated into 15—21, moderately strong teeth (pl. XVII, fig. 32). In profile view the disc is frequently observed to present just a slight indication of a rounded angularity at the apex; the surface

around this slopes down very gradually towards the margin, in which parts the sloping takes a somewhat steeper turn.

Any hexaster, other than those which I maintain to be intrusions from *Farrea occa mammillata*, have not been discovered, probably owing either to loss or to their extreme rareness.

The uncinate was found in some number in the preparations. It varies much in dimensions and seems to differ but little or not at all in appearance from that of *Farrea occa*. One of the smallest uncinates found measured only 412 μ long and 4 μ thick, while some of the large ones were 1184 μ by 8 μ, 2530 μ by 13.5 μ, 2820 μ by 11.5 μ, etc. in dimensions. In the smaller uncinates the barbs are obsolete or indistinct; in the larger ones they are developed, though not very numerously, in the form of straight and slender spines nearly appressed to the shaft surface.

Finally a few words on the probable nature of the above described specimen. I have already noted that both its two faces are to be regarded as dermal. That precludes the idea of its being a lamellarly developed sponge wall with opposite incurrent and excurrent surfaces. Then the inevitable conclusion is that the specimen must be an external projection from the dermal side of a sponge and detached from this by breaking off at its base. Deriving suggestion from the established characters of *Pleurochorium schulzei* and *P. annandalei*, it seems indubitable that the fragmentary specimen in question is nothing else than one of the external appendages, similar to those of the species just mentioned. In this relation, *P. cornutum*, represented by the first described tubular specimens at once presents itself as the species to which the said fragment most probably belongs. I mean not that it was derived directly from those specimens but probably from still another example of the same species. Apart from the identity of locality of all the specimens concerned, there are other points which stand strongly in support of the view. In the first place, the thickened lateral parts at the base of the fan-shaped fragment may well have originally stood in connection each with each of such paired processes as we have seen on the sides of lateral oscula in the tubular specimens. In the next place, the agreement between the two in important points of spiculation is patent. This is especially true with regard to the structure of dictyonal skeleton and to the highly specialized form of scopule with pileate head-branches. It is unfortunate that the hexaster was not discovered in the flabellate specimen and so cannot be utilized as a factor of comparison.

Genus **Periphragella** W. Marshall, 1875.

Periphragella Marshall, 1875, p. 177; 1876, p. 123. — F. E. Schulze, 1887, p. 299.

Euretids shaped like a vase or a bowl, always with a large terminal osculum above and a number of smaller lateral oscula on stump-like, or branching and anastomosing, tubular branches on sides. Gastral surface with openings of branch tubes; not fluted. Dictyonal framework formed of a many-layered latticework of tubercled beams which are in part rectangularly intersecting and in part irregularly intersecting. Spikes without boss-like base; elongate-conical or finger-like. Dermalia and gastralia pentactins, but sometimes with the sixth (externally directed) ray short. Dermal and gastral scopules with head-branches distinctly knobbed at end. Oxyhexaster constantly present; usually, but not always, in the form in which the principals are greatly elongated. A second form of hexaster occurs in the form of discohexaster with moderately short

principals or in the form with more or less elongate principals bearing terminals which are either knobbed (tylohexaster) or simply rounded at end.

The genus as defined above contains the five living species given below.

1. *P. elisæ* Marshall. (Marshall, 1875, p. 177; pl. XII, fig. B, pls. XIII and XIV, figs. 24—31; Ditto; 1876, p. 123. — Carter, 1885, p. 394. — F. E. Schulze, 1887, pp. 299, 394; pls. LXXX and LXXXI). This species was originally described by Marshall from a specimen which was obtained in the Moluccas. Later, H. J. Carter and F. E. Schulze identified with that species some specimens from Japan (Sagami Sea). I think there is left some room to doubt if the above authors were quite correct in that identification, in as much as there exists a notable difference between Marshall's description and the Japanese specimens as regards the hexaster other than the oxyhexaster. In fact, instead of the small (19—31 μ diameter) tylohexaster found in the Japanese *Periphragella*, with delicate terminals (4—6 in a broad umbel) distinctly longer than the principal, the type specimen from the Moluccas should possess a peculiar hexaster variety (40 μ axial length), in which each moderately long principal ends with a swelling concave on the outside and provided marginally with five, unknobbed but roundly ending, short and tooth-like terminals. As a further, but less significant, point of difference may be mentioned that, whereas in the Japanese *Periphragella* the stalk to the knobbed end-prongs of scopules is gently bent and finely barbed, the same in the Moluccan specimen was figured by Marshall straight and smooth. However, in view of the far going agreement in all other respects, I may follow Carter and Schulze in calling the Japanese specimens by the specific name given by Marshall. Perhaps it may be advantageous to refer to the Japanese form by the name of *P. elisæ japonica*.

2. *P. challengeri* n. sp. This is a species which is founded, not on first hand observations of my own, but on the account and figures given by F. E. Schulze in the Challenger Report (p. 304; pl. LXXXII, figs. 2—8) of two small specimens from off Little Kei Island and a depth of 140 fms. No name was given them by the above author, who regarded them to be young individuals not sufficiently differentiated to admit of a distinct diagnosis and from which an *Eurete* or *Periphragella* or even *Lefroyella* might quite well develop. In spite of that fact it seems to me that the data, reported by F. E. Schulze, are sufficient to justify giving the specimens a position in the genus *Periphragella* as a distinct species. I have been led to that view from the experience that in the Hexactinellida generally, specific characters in connection with individual spicules become established very early in the development, when the sponge is still quite small. I have therefore decided to call the specimens in question definitely by the name of *P. challengeri*. — As chief points in the characterization of the species may be given: Tubular-vase-like, with lateral oscula at end of short tubo-branches. Dictyonal beams thickly beset with coarse and fine tubercles, swollen at nodes. Dermal and gastral pentactins with smooth rays roughened at end. Scopule with 4 or 5 end-prongs each of which consists of a thin, smooth and either slightly bent or geniculate stalk and of a barbed club-like terminal bulb. Oxyhexaster with moderately short principals, each bearing two long terminals. Discohexaster with principals also moderately short and ending each with a disc, from the margin of which arise numerous long and slender terminals in a broad umbel and furnished with small, marginally toothed, terminal disc. (Drawn up from F. E. Schulze's description and figures.)

3. *P. lusitanica* Topsent. (Topsent, 1890; Ditto, 1892, p. 31; Ditto, 1895, p. 215. = *Chonelasma schulzei*, Topsent 1890; Ditto, 1892, p. 33; Ditto, 1901, p. 458; Ditto, 1904, p. 51). Known from Azores. The species was last called by Topsent (1904) *Chonelasma schulzei*, making his *Periphragella lusitanica* a synonym of that name. In my view the two kinds of hexasters known from the species (oxyhexaster and disco- [probably tylo-]hexaster, both with elongate principals) mark it as a form of a much nearer relationship to *Periphragella* than to any species that has been ascribed to *Chonelasma*. I have therefore chosen, from the two different names which were simultaneously given to the form by Topsent, as declared by himself (1904), that which refers it to *Periphragella* as probably the more appropriate to retain.

4. *P. parva* n. sp.

5. *P. irregularis* n. sp.

The above two species, both obtained by the Siboga and apparently new, will soon be described in full.

Of the fossil forms three species have been assigned to *Periphragella* by Schrammen (1910—1912, pp. 214, 215), viz.: *P. plicata*, *P. simplex* and *P. johannæ*, all from the Upper Cretaceous of Oberg in northwestern Germany.

The genus is probably most nearly related to *Eurete* and *Pararete*. The stock habitus of both these genera may readily be derived from that of *Periphragella* by assuming that the central calyx and the peripheral anastomosing tube-branches of the latter remain the same in the caliber and are therefore not distinguishable in the former.

It has been suggested that W. Thomson's *Lefroyella* is possibly identical with *Periphragella*. Remaining, as we do, in nearly complete ignorance with respect to the loose spicules of the former, anything definite can scarcely be opined as to the relation of the two genera, but there exist in the condition of their wall sufficient differences which seem to justify their generic separation.

So far as concerns the two hexaster sorts found in *Periphragella*, there is a notable similarity between that genus and certain species of *Farrea*, as f. i., *F. vosmaeri*, *F. sollasi*, *F. lendenfeldi*, *F. weltneri*. Further it may be pointed out that the long-principalled oxyhexaster of *Periphragella* is of the same type as that of *Bathyxiphus*, *Tretodictyum* and *Sclerothamnopsis*, while the long-principalled tylohexaster agrees with the same of many *Hexactinella* species (f. i., *H. ventilabrum*, *H. grimaldii*, *H. lingua*) and of *Psilocalyx*.

1. *Periphragella parva* n. sp. (Plate XIV, figs. 1—12).

Stat. 267. 5° 54′ S., 132° 56′.7 E. 984 m. 6 specimens.

Diagnosis. — Body like a little vase, with a large terminal osculum above and a number of lateral oscula which are arranged in approximately longitudinal rows and open generally either on low prominences or under lip-like or hood-like projections of the wall. Dictyonal framework with meshes, in part subrectangular and in part irregularly shaped; beams microtubercled. Dermal and gastral pentactins with paired rays which are sometimes weakly tuberculate, at other times densely spiny on the outer side. Scopule not over 330 μ long, with end-prongs up to 50 μ long and always distinctly geniculate, ending with a large or moderately

large bulb, armed with barbs in circles. Oxyhexaster 77—97 in diameter, with long principals, each with 2 or 3 strongly divergent terminals which may be longer or shorter than the principal bearing them. Tylohexaster 60—70 μ in diameter, with long principals; terminals in the larger hexaster about as long as the principal and forming lily-flower-like perianths; those in the smaller, shorter than the principal and forming bell-shaped perianths.

Description. — There are six small specimens of this new species, all from Stat. 267, a spot near the southern end of Great Kei Island. Three of them are fragmentary; and of the remaining three, two (pl. XIV, figs. 1, 2) are in a good state of preservation, while one (pl. XIV, fig. 3) is completely macerated though nearly entire as regards the skeleton. The three specimens just mentioned are respectively 22 mm., 17 mm., and 28 mm. high. They may summarily be described as being of an irregular vase-like shape, nearly erect or slightly bent, broadest in the upper parts, somewhat contracted at the uppermost end, and with broad basal parts below. The wall is in most parts 1—2 mm. thick. A large terminal or main osculum opens at the top. It is of a lobate outline, due to the folding of the margin as a preliminary step in the formation of new lateral oscula. The lateral oscula occur in numbers on the sponge wall, arranged in 4—6, approximately longitudinal rows. They are small roundish apertures up to about 2 mm. in diameter, each opening generally either surrounded by a ring-like prominence which may sometimes be prolonged into a short tube, or under a lip-like or hood-like projection produced by the upper parts of the margin growing out in excess of the lower parts of same. The hood-like projections, overhanging most lateral oscula, are most manifest in the largest specimen shown in pl. XIV, fig. 3. Between the longitudinal series of lateral oscula, there intervene depressed valley-like spaces of the lateral sponge surface. The general appearance of the sponge is not unlike that of the doubtful forms which were described and figured by O. Schmidt under the names of *Dactylocalyx crispus* (1870, p. 19; pl. II, fig. 13) and *Scleroplegma seriatim* (1880, p. 57; pl. VIII, fig. 5).

The dermal surface shows a moderately frequent occurrence of small epirhysial orifices, which, in the intact state of the surface, should be covered over by the dermal layer.

The gastral cavity is somewhat irregular owing to its radial extensions in relation to lateral oscula. Its wall, perforated by aporhysial apertures, appears much like the dermal surface. Gastral longitudinal ridges and grooves, such as occur in *Lefroyella decora* W. Thoms. or in *Syringidium zitteli* O. Schm., do not exist in this species as in *Periphragella elisae* W. Marsh.

Spiculation. — The dictyonal skeleton is made up of a framework, the meshes of which are in part subrectangular but more generally rather irregular-shaped, measuring up to 450 μ in the length of longest side. The beams are generally 40—80 μ thick and are micro-tubercled, most distinctly and uniformly on those of the periphery (pl. XIV, fig. 10), but frequently sparsely and irregularly on those in the deeper parts of the wall. The tuberculation is more pronounced than in *Periphragella elisae* of Japan. The nodes are not markedly swollen. The spikes, both dermal and gastral, are densely tuberculated as usual, and elongate-conical or slim and finger-like in shape. The superficial nodes from which they arise do not show boss-like swelling at their base.

The dermal pentactin (pl. XIV, figs. 4, 5, 10) varies much in dimensions and in the development of tubercles on the rays. The paired rays are 120—230 μ long and 3—7 μ thick;

they are just perceptibly bent so as to be concave on the inner side and more or less distinctly microtubercled on surface. The unpaired proximal ray is about as long, and either nearly as rough or distinctly less so. A swelling in place of the atrophied distal ray does not exist. The relatively shorter but stronger rayed ones (fig. 5) of the dermalia have the paired rays markedly rough, being crowdedly beset with microtubercles which, on their outer side, are frequently seen to be developed into vertical spinules. Others of the dermalia, especially the longer but more slender rayed ones (fig. 4), have rays which are sparsely and much more weakly microtubercled or may even be nearly smooth, except at the tubercled end. The two kinds of dermalia occur promiscuously together, though in certain places either of them may be found nearly in exclusion of the other.

The gastral pentactin is like the dermal. It is mostly rather sparsely and weakly tubercled, occasionally thickly and strongly.

The dermal scopule (pl. XIV, fig. 6) is numerously present, often grouped together into bundles. It is 275—330 μ long. The end-prongs, 43—50 μ long, number 2—4 to a spicule, are invariably nearly parallel in the basal third of their length, and more distally strongly divergent and at the same time slightly curved so as to be convex on the outside. At the end they are swollen into relatively large bulbs armed with barbs in about 4 circles around them. The bulbs are 8—15 μ, mostly about 11 μ in diameter. The stalks are smooth, not barbed as in *P. elisae*.

The gastral scopule (pl. XIV, fig. 7), also numerously present, is quite like the dermal; only slightly shorter, measuring 220—275 μ long, and the terminal bulbs on the whole perceptibly smaller, being not over 10 μ in diameter.

The oxyhexaster (pl. XIV, figs. 11, 12) is found in very great abundance. It is 77—97 μ in diameter. Each long principal carries 2 or 3 strongly divergent terminals which are either somewhat longer or shorter than the former.

The tylohexaster (pl. XIV, figs. 8, 9) is less numerous, though common. The diameter measures 60—77 μ. The principals are long and bear each 4—6 slender terminals ending with minute knobs. In the larger tylohexaster they are about as long as the principal and form an umbel of a lily-flower-like shape to each principal. In the smaller tylohexaster the terminal umbel is of a bell-like shape and shorter than the principal.

Long and slender uncinates are numerous and are found in bundles. They may reach 4 mm. or over in length and 13 μ in greatest thickness. The barbs are appressed against the shaft.

Remarks. — *P. parva* is apparently a form very nearly related to *P. elisæ*, from which it may perhaps not be separable specifically but only as a subspecies or a local variety. The specimens on which I have based *P. parva* are possibly young stocks, which, on farther growth, may yet acquire the appearance proper to *P. elisæ*. As to spiculation, the presence of dermalia with densely spiny paired rays, together with others in which the same rays are but weakly tuberculated, seems to constitute one of the chief features peculiar to the present form. The form agrees with the Japanese specimens of *P. elisæ* in the fact that the hexaster, other than the oxyhexaster, is a tylohexaster (though of a slightly different shape); but it differs from the type specimen (from the Moluccas) described by MARSHALL in which the corresponding spicule should be a peculiar hexaster of which the short terminals are relatively strong tooth-like

processes simply rounded at end, instead of tylote. The smaller tylohexaster in *P. parva* with terminals shorter than the principal and the umbel of terminals of a bell-like shape may be regarded as a modification of tylohexaster rather than the oxyhexaster, described by MARSHALL (1875) from the type specimen of *P. elisæ*.

2. *Periphragella irregularis* n. sp. (Plate XIV, figs. 13—20).

Stat. 156. 0° 29′.2 S., 130° 5′.3 E. 469 m. 7 specimens.

Diagnosis. — Stock small, consisting of an irregular labyrinthic clump of anastomosing tubes, attached below by a small pedicel or pedicels, and with a main osculum opening on top, besides several much smaller oscula on the tubes. Dictyonal framework small-meshed and with tuberculation on beams, the tubercles tending toward an arrangement in transverse rows. Dermalia and gastralia are weakly rough hexactins, which approach a pentactin in that the outwardly directed ray is very much shortened. Scopule with 4—7, straight end-prongs terminating with small, weakly barbed bulb. Oxyhexaster 54—90 μ in diameter, each long principal bearing usually 2, moderately strongly divergent terminals which are more or less distinctly shorter than itself. No other hexaster kind has been found.

Description. — Seven specimens of this apparently new species were obtained by the Siboga at her Stat. 156, a spot to the east of Gagi Island in the Halmaheira Sea. Two of them are shown in pl. XIV, figs. 13—15.

All the specimens are small stocks of an irregular clumpy shape, the largest (fig. 13) being 28 mm by 18 mm. in breadth and probably not much over 20 mm. in height (damaged in the upper parts). The bleached but otherwise completely preserved specimen shown in figs. 14 and 15 is of an irregularly urn-like shape, measuring 17 mm. broad in the broadest part and about 20 mm. high. The sponge is attached to the substratum — either a dead *Farrea* tube or pieces of a branching coral — by the short stalk-like base or by means of small pedicel-like processes at more than one place of the periphery.

The stock in its major portion may be described as being made up of irregular anastomosing tubes of a width varying from 2 mm. to 6 mm. in diameter and with wall of from 0.5 mm. to nearly but not quite 1 mm. thickness. The tube wall is fenestrated at intervals by roundish apertures, the lateral oscula, of 1—3 mm. diameter. These are generally simple perforations on the wall surface but may sometimes be situated at the end of short and free tubobranches. The anastomosis of the tubes occurs at close intervals, so that the intertubal spaces are not always readily distinguishable from the tube lumen. The above lateral oscula open not exclusively on the exposed external surface of the sponge, but frequently also into the intertubal space at its deeply situated parts. Moreover, it seems that there are sometimes developed bridge-like dictyonal connections between neighbouring tubes, which connections partially shut in the intertubal space from the external world. Thus, there may arise a complex of labyrinthic passages which are divided from one another by the tube wall but may intercommunicate and which consist in part of the lumina of the tubes and in part of the intertubal spaces.

Apart from the small lateral oscula, there occurs on top of the stock a relatively large osculum surrounded by the slightly flaring marginal edge. It may be designated as the main

osculum. It is irregularly shaped and may measure about 10 mm. across. The wall around it bears some simple lateral oscula, besides showing at the free edge some indentations which represent early stages in the formation of new lateral oscula. At least two of the specimens before me plainly exhibit the above main osculum. In the remaining specimens it cannot be clearly made out, owing, I think, to damages sustained by them in the parts. The insignificant gastral cavity directly within the main osculum leads below, without definite demarcation, into the anastomosing tubes mentioned before. The gross structure of the sponge may be regarded as essentially the same as in *Periphragella elisae*, but with this difference that, while in that species there exists centrally a large vase-like mother tube, bearing much smaller tubes on the sides, in the present species the central tube remains narrow and is thus scarcely distinguishable in appearance from the lateral tubes it has produced.

Spiculation. — The dictyonal framework (pl. XIV, fig. 20) is of much the same appearance as that of *P. elisae*; only it is distinctly more close-meshed and is made up of beams which differ in the manner of tuberculation. In certain parts of the stock the meshes are irregular-shaped throughout, measuring generally not over 275 μ across. In most other parts they are similarly irregular only along the external surface of the wall, while in the deeper parts of it they are moderately regularly rectangular, being more or less elongate in the direction of tube length. Such a mesh may be 330 μ long and about half as wide. Generally only 2 or 3 meshes can be counted in the entire thickness of the wall in section. The nodes are not markedly swollen. The beams may reach 90 μ, but are more usually 60 μ and under, in thickness. Their surface is numerously beset with simple small tubercles, which tend toward an arrangement in transverse rows. This state of the tuberculation reminds one of that in certain Tretodictyids (*Hexactinella lata*, *Tretodictyum schrammeni*, *T. spongiosum*). On certain beams the tubercles are set distinctly and fairly close together in such rows of a variable length; on others this arrangement is not so very manifest, though scarcely ever quite irregular. The spikes are thickly tubercled as usual. These are variously developed, reaching up to 220 μ in length, and may be slenderly finger-like or of an elongate-conical shape, rounded at end. Frequently 2 or 3 spikes spring out from a node, indicating the composite origin of this from a hexactin centrum and an amalgamated ray or rays from other hexactins. No constant difference is observable in the manner of development of the spikes on the two opposite sides of the wall.

The dermal layer consists of relatively weak-rayed hexactins, in which the free distal ray is very much shortened and peg-like with rounded tip (pl. XIV, fig. 16). That distal ray is 25—75 μ long; the paired paratangential rays 165—230 μ long; the proximal ray nearly as long or somewhat longer. All the rays are about 10 μ thick. They are finely rough all over the surface. The gastralia are similar to the dermalia.

The scopule is found commonly on the gastral side of the wall, but is rare on the dermal side (pl. XIV, figs. 18, 19). Total length 250—550 μ; length of end-prongs 38—66 μ; thickness of shaft from about 4 μ or less to nearly 6 μ. The end-prongs in a tuft number 4—7. Distally the prongs diverge from one another in varying degrees, not infrequently so very widely that the tuft at the outer end may be nearly as wide as, or even somewhat wider than, it is long. In the more strongly expanding tufts the prongs may show a slight inequality in their length; moreover some of them are sometimes seen to diverge from the axial line more strongly than

the rest (fig. 18). The prong stalks are rather slender, nearly straight (not geniculate), and obsoletely rough or nearly smooth. Terminally they end with a small but distinct bulb, which obscurely shows some whorls of abortive barbs. The shaft is faintly rough only near the inner end.

The only hexaster found in the species is an oxyhexaster form (pl. XIV, fig. 17) with prolonged principals, each of which is provided with usually 2, rarely 3 terminals, distinctly shorter than the principal bearing them. It is small, measuring 54—90 μ in diameter. The principals are 15.5—26 μ long, the terminals 11.5—21 μ. The oxyhexaster is quite common in all parts of the wall.

Uncinates of various dimensions occur in moderate abundance, disposed in part vertically to the wall surfaces and in part more or less parallel to these. A very small one measured only 320 μ long by 4 μ thick; one of the largest met with about 1.5 mm. long by 12 μ thick. Smooth rhaphidial needles do not occur.

Genus **Lefroyella** W. Thomson, 1877.

Notes on the genus and species. — Vase-like or tubular and more or less expanding above. Skeleton externally with ridges and grooves, the former bearing lateral oscula as simple perforations or at end of tubular stumps. Gastral surface with alternating longitudinal grooves and ridges, the former opening externally by lateral oscula and both together giving a fluted appearance to the surface. Dictyonal framework irregular-meshed in external parts, but more or less regularly rectangular-meshed in deeper parts, with a set of long strands running longitudinally. Loose spicules not known with certainty.

Of this genus, a single living species, *L. decora* W. Thoms. from W. Indies and the neighbourhood of the Bermudas, has hitherto been known, besides the fossil *L. favoidea* Schram. from the Upper Cretaceous of Oberg. To these, *L. ceramensis* n. sp. is now added from the Siboga collection.

L. decora W. Thomson (W. Thoms., 1877, p. 403, fig. 106; F. E. Sch., 1886, p. 73; Ditto, 1887, pp. 302, 394; pl. LXXXII, fig. 1. = ? *Dactylocalyx crispus*, O. Schm., 1870, p. 19; pl. II, figs. 13—15. = *Syringidium zitteli*, O. Schm., 1880, p. 47, pl. IV, figs. 9, 10; pl. VII, figs. 4 A, B.). *Lefroyella* vasiform and of a moderately large size with thick wall. Skeleton with external ridges and interjacent depressed zones, running transversely or obliquely; the former consisting almost wholly of a row of closely apposed and externally fused tubular stumps, 4—5 mm. broad. Dictyonal beams smooth except on spikes. Some uncinates of medium length and scopules with four straight and terminally knobbed end-prongs were observed by F. E. Schulze, but it is not certain if both really belonged to the specimen in which they were found.

L. favoidea Schrammen (1912, p. 216). Hazelnut size, conical thin-walled. External tubular stumps close together in longitudinal rows or in indistinctly spiral arrangement.

1. *Lefroyella ceramensis* n. sp. (Plate XXI, figs. 1—7).

Stat. 177. 2° 24'.5 S., 129° 38'.5 E. 1633 m. 1 specimen.
Stat. 226. 5° 26'.7 S., 127° 36'.5 E. 1595 m. 2 specimens.

Diagnosis. — Tubular and more or less expanding above, moderately thick-walled,

with external skeletal ridges irregularly reticulating and running on the whole longitudinally. Lateral oscula 1—2 mm. in diameter, in interrupted and indistinctly longitudinal series. Dictyonal beams of all parts microtubercled; the meshes in deep parts greatly elongated in longitudinal direction. Loose spicules unknown.

Description. — As type of this new species has served the specimen which was obtained at Stat. 177, a spot to the north of Ceram (pl. XXI, figs. 3, 4). To the same species are probably to be referred two more specimens from Stat. 226, between Schildpad and Lucipara Islands in the middle of Banda Sea (pl. XXI, figs. 1, 2, 5). All are not only much defective in parts of body but also long dead and completely water-washed. Their general appearance is such as reminds one at once of *Syringidium zitteli* figured by O. Schmidt and of *Lefroyella decora* by F. E. Schulze.

The type specimen from Ceram Sea is a tube broken off at both ends, 67 mm. long and about 15 mm. and 20 mm. in diameter respectively at the lower and upper ends. The wall is 3—6 mm. thick at the lower end and 3—4 mm. at the upper. The specimen was cut longitudinally into two halves, one of which is shown in pl. XXI, fig. 3 in external or dermal view and the other in fig. 4, same plate, as seen from the gastral side. The dermal surface is rough, owing to the occurrence of irregular anastomosing ridges of varying breadth and prominence. On the whole the ridges take a longitudinally directed course; consequently, many of the interjacent mesh spaces represent longitudinally elongate, groove-like but not deep depressions. These are of a varying length and not over 2 mm. in width. At their bottom are seen a number of closely lying, small recesses, which are manifestly epirhysial canals shut off internally from the gastral cavity by deep-lying dictyonal tissue of the choanosome. Certain other small meshes of the external rude ridge-reticulum are of a roundish shape with a diameter of 1—2 mm., and are readily recognizable as external apertures of short radial canals, leading freely into the radial grooves of the gastral cavity. The same apertures may as well be described as more or less crater-like openings occurring on certain external ridges specially broadened in the parts. Sometimes they appear as simple perforations on the ridge surface; more frequently they are each surrounded by a low annular wall of 2—4 mm. diameter. The apertures in question are in a way irregularly distributed, but with this exception, that whenever two or several of them occur particularly close together, all these are almost always found arranged in longitudinal series in relation to the course of the ridge on which they are situated and which, in its turn, stands in relation to the longitudinal grooves (to be soon described) of the gastral surface. As regards the external tubular stumps of *L. decora*, it was pointed out by F. E. Schulze (1887, p. 303) that they represent the efferent lateral tubes of *Periphragella*. I quite concur in that opinion and unhesitatingly regard the openings at the outer end of those stumps to be lateral oscula in distinction from the main osculum at the upper end of the stock. Without doubt all the similar apertures, whether surrounded by a ring wall or not, on the lateral wall of *L. ceramensis* are to be looked at in the same light.

There seem to exist considerable differences in the character of the external surface of the skeleton between the present species and *L. decora*. In the latter, the closely apposed and fused tubular stumps are known to form ridges, which, together with the depressed zone between them, run transversely or obliquely instead of longitudinally. Further, the said stumps (4—5 mm.

thick) and the lateral oscula at their ends are much larger in *L. decora*. It is chiefly on account of these differences that I regard the two species as distinguishable from each other.

Were the dermal layer preserved, it would probably be found to cover the surface (with interruptions of course at each and every lateral osculum), closely following the external elevations and depressions, that is to say, without spanning over the latter and leaving these as subdermal channels, such as the interseptal diarhysial spaces of *Hexactinella* are.

The gastral surface (pl. XXI, fig. 4) is of quite a different character, presenting, as it does, a pronouncedly fluted appearance. It may be described to consist of a number of longitudinal, 1—2 mm. broad ridges and interjacent, deeply slit-like grooves of about 1 mm. average width. The grooves communicate externally on the dermal side by the above mentioned lateral oscula, situated in longitudinal series at varying intervals. At the lower end of the specimen there are in all nine gastral ridges; about 40 mm. above that end, the ridges number fourteen or thereabout, the increase in number being due to occasional splitting of the ridges in their upward course. They appear in surface view loosely, longitudinally fibrous. Across the gastral grooves there exist relatively narrow, transverse connective septa or bridges, which either completely or incompletely cut off their continuity. The interval between two consecutive connections in the same groove may vary from 1.5 mm. to 10 mm. or even 15 mm. in length. As was shown by F. E. SCHULZE for *L. decora*, the longitudinal gastral ridges are not entirely solid, so to speak, but are more of the nature of longitudinal folds of the sponge wall. On the external side of the wall the outwardly directed folds, in conjunction with auxiliary ridge formations, form the irregular ridge reticulum of the external surface; the inwardly directed folds, projecting on the gastral side, bring about the nearly parallel longitudinal gastral ridges which are here and there transversely connected together by auxiliary dictyonal ridges and bridges of an inferior breadth. The condition of the gastral ridges and cleft-like depressions between them appears at first sight to be comparable with the choanosomal septa and the longitudinal diarhysial canals of *Hexactinella*. But, in my view, a diarhysis does not exist in *Lefroyella*, the only perforations through the lateral wall being those which seem to be decidedly oscular in nature (lateral oscula). Hence, a choanosomal septum in the same sense as in *Hexactinella* appears to be out of the question in *Lefroyella*.

The dictyonal tissue is made up of beams generally 40—90 μ thick and beset with weak conical tubercles, more scattered on some than on others. The tuberculation is especially weak on the beams and strands of the innermost parts, where it may cause only a faint roughness of the surface. In *L. decora* the beams should be smooth; another point in which that species seems to differ from the present. In the outer cortex of the wall (pl. XXI, fig. 7) the dictyonal network is irregular, with meshes not over 385 μ in width. The nodes are not specially thickened; they generally represent sexradiate spicular centers, there being besides a not uncommon occurrence of beams in fusion at places other than the true nodes. Externally, the spikes are mostly broken off, but to judge from the few which still remain, they are of a weak development, being small finger-like processes, rough on surface as usual and commonly not longer than 120 μ. On the internal surface of radial canals, just inside the lateral oscula, the spikes are especially strongly developed. Here they measure up to 300 μ long and 70 μ thick, and are always rounded at end; they give to the parts a spiny appearance as observed under the hand-lens.

The gastral ridges seen on edge (pl. XXI, fig. 4, median parts) display, as before mentioned, long longitudinal strands which run 100—275 μ apart from one another and are intersected by transverse beams at varying intervals. In fact we have here to do with a three-dimensional latticework in which the generality of meshes vary in shape from approximately square to greatly elongated in the longitudinal direction (pl. XXI, fig. 6). Frequently a mesh is nearly 1.5 mm. long by a width of about 0.25 mm. The regularity of the meshwork is much disturbed, also by the not infrequent occurrence of such beams or strands as take an indefinite direction and either meet or intersect others at variable angles. The spikes on the gastral surface seem all to be of quite an insignificant development. — On lateral sides as well as in radial sections of the wall folds (pl. XXI, fig. 4, left side), the strands of the longitudinally running set are seen, in their course from below upwards, to curve gently outwards and towards the dermal surface. Together with those which intersect them, they form a moderately regular rectangular-meshed latticework. — The transverse septa and bridges across the gastral grooves consist of irregularly reticulating beams as in the cortical parts of the wall.

To the same species I am inclined to refer two specimens from Stat. 266 in Banda Sea. One of these is shown in two views in pl. XXI, figs. 1 and 2, and the other in pl. XXI, fig. 5. Both are again completely water-washed skeletons; they represent the inferior parts of body, preserving the basal attachment surface at the truncate lower end but lacking the superior body parts. They both have the deep gastral cavity extending down to within a short distance from the lowest end, and in relation to that fact, the external surface exhibits lateral oscula and epirhysial apertures distributed close to the edge of the basal attachment surface. A solid stalk practically does not exist in either of the specimens.

One of the specimens (pl. XXI, fig. 5) may be said to compare perfectly well with the type specimen in all points, except in this regard, viz., that the external ridges and depressions, though unmistakeably present in the uppermost parts of the specimen, are not observable in the remaining greater parts. This state of the surface seems to be due simply to the fact that, in those old parts of the sponge, the external depressions have become filled in by continued growth and quantitative increase of the cortical dictyonal tissue, without the existent incurrent canals of the parts having become obliterated thereby.

The other specimen, shown in pl. XXI, figs. 1 and 2, differs from both the specimens already described in the general shape of body, consisting, as it does, of a relatively short and laterally compressed basal part which expands above in a funnel-like manner. The wall is very thick. The upper parts show externally some broad irregular depressions which render the surface boldly rough. In other respects, the characterization of both the wall surfaces is essentially the same as in the last described specimen.

Genus **Myliusia** J. E. Gray, 1859.

Diagnosis. — Cup-like or vase-like, with large main osculum above and numerous smaller accessory oscula, the latter opening at outer end of lateral pleural outbulgings and in part also into irregular intercanals between these. Without formation of diarhysis in the canal system. Dictyonal beams with profuse conical tubercles arranged in transverse rows or showing

a tendency towards that arrangement; the nodes generally multiradiate and many of them, but especially those externally exposed, showing characteristic, tubercle-bearing, wart-like prominences. Dermalia and gastralia generally hexactins with short distal and prolonged proximal ray; both may in part be pentactins. Hexaster consists of discohexaster and oxyhexaster, or of the former only. Scopule not recorded. Uncinate not surely known.

Myliusia, together with *Margaritella* O. Sch., is now taken under the Euretidae, after dissolution of the Dactylocalycidae in which both the genera were at one time placed by me (IJ., 1903, p. 25).

The genotype is *Myliusia callocyathus* Gray, 1859, originally described from W. Indies and later reported also from E. Indies (Banda Sea). In the Siboga collection there are some specimens which may be referred to that species. However, since the W. Indian specimens are very inadequately known, having as yet been described from washed-out skeletons only it may possibly become necessary in the future to make some sort of distinction between them and the E. Indian form. In addition the Siboga obtained in the Philippine waters an apparently new form which will be described in this report under the name of *M. verrucosa*. Further one or two more species recorded in the literature under generic denominations other than *Myliusia* may be taken under that genus. The one is *Scleroplegma conicum* O. Schmidt (1880) from Morro Light, W. Indies. This form, as described and figured by F. E. SCHULZE (1887) from O. SCHMIDT's type specimen, is similar to *M. callocyathus* Gray in general structure and strikingly so in the peculiar tuberculation of the dictyonal skeleton, while no facts are known which differentiate one from the other to any marked degree; under which circumstances it scarcely appears appropriate to hold the two forms separate, generically at any rate and perhaps even specifically [1]). Another old species which seems to me to be better referable to *Myliusia* than to any other known dictyonine genus is GRAY's *Dactylocalyx subglobosus* from Malacca (?) (*D. subglobosa*, GRAY, 1867, p. 506; CARTER, 1873, pp. 359, 364 = *Iphiteon subglobosa*, BOWERBANK, 1869, p. 329; not *Dactylocalyx subglobosus* of O. SCHMIDT, 1880, p. 53 and F. E. SCHULZE, 1887, p. 349, which is from W. Indies and is doubtfully identical with *Dactylocalyx ingalli* (Bowerbank) = *Iphiteon ingalli* Bowerbank, 1869, pp. 78, 331). The species in question appears to be a well characterized one, with spiculation showing a far-reaching agreement with that of *Myliusia callocyathus*, especially in the manner in which the dictyonal beams are beset with tubercles and certain of the nodes with tuberculated warts (cfr. Bwbk. 1869, p. 330; pl. XXII, fig. 10). However, without a better knowledge of the species than we at present possess, it is difficult to definitely determine its generic status.

After what I have said I regard for the present the genus *Myliusia* to comprise the following four living species:

1. *M. callocyathus* Gray. W. & E. Indies.
2. *M. verrucosa*, n. sp. E. Indies.
3. *M. conica* (O. S.) = *Scleroplegma conicum* O. S. W. Indies.
4. *M.? subglobosa* (Gray) = *Dactylocalyx subglobosus* Gray. Malacca?

1) Of other *Scleroplegma* species put forth by O. SCHMIDT (1880, pp. 56, 57), *S. lanterna* is an Aulocystid of uncertain status, while *S. seriatim* and *S. herculeum* are probably Euretids but are likewise too imperfectly known for exact generic determination. The latter remark may be said to apply also for the fossil which SCHRAMMEN (1910—12, p. 227) has called *Scl. macrochorium*.

1. *Myliusia callocyathus* Gray, 1859 (Plate XXIV, figs. 13—16).

M. callocyathes Gray, 1859, Proc. Zool. Soc. Lond., vol. XXVII, p. 439, pl. XVI; Ann. & Mag. Nat. Hist., 3rd ser., vol. V, p. 497. — Gray, 1867, Ibid., 1867, p. 506. — Bowerbank, 1869, Ibid., p. 76. — Carter, 1873, p. 358, pl. XIII, fig. 10. — *M. callocyathus* F. E. Schulze, 1886, p. 87. — F. E. Schulze, 1887, p. 354, pl. CIII.
Iphiteon callocyathes Bwbk, 1869, p. 333; pl. XXIII, figs. 4—7.
Dactylocalyx callocyathes W. Thomson, 1870, Phil. Trans. CLIX, p. 713. — ? *D. callocyathus* O. Schm., 1880, p. 54, pl. VIII, figs. 1—3.

Stat. 251. 5° 28′.4 S., 132° 0′.2 E. 204 m. Four specimens and some fragments.

Diagnosis. — Thick-walled cup, much convoluted or corrugated on the outside, on account of the presence of deep irregular depressions. Funnel-like central gastral cavity with wide main osculum above; the wall forming a number of irregular radial tubes open at the external end; between them are meandering and anastomosing intercanals, about as wide as the tubes and at places arched over by dictyonal bridges but otherwise opening by irregular external apertures like those of the tubes; the two canal systems separated by a septum-like wall of moderate thickness. Dictyonal framework irregularly meshed, composed of beams beset with transverse rows of small conical tubercles and united by nodes to which usually more than six beams are joined; the thicker nodes, found mostly on or near the surfaces of the framework, show a varying number of broad tubercled warts; outermost nodes on both dermal and gastral surfaces without freely projecting peg-like ray or spike. Dermalia and gastralia are oxypentactins and sword-shaped hexactins. Hexasters are holoxyhexaster, hemioxyhexaster and monoxyhexaster, and further, floricome-like discohexaster with marginally toothed terminal discs.

Known from West Indies (Gray; O. Schmidt; Chall. Stat. 24, 390 fms.), Kei Islands (Chall. Stat. 192, 140 fms.; Siboga), and near Banda I. (Chall. Stat. 194, 200 fms.).

Description. — The Siboga collection contains four small specimens, which, in spite of their being all dead or completely water-washed, may be identified with *Myliusia callocyathus* of Gray. They were procured from Station 251, S. of Kur I., among the Kei Islands, a spot not very far distant from where the Challenger had obtained some specimens of the species. Aside from the proximity of the localities, the Siboga specimens may be said to agree completely with the descriptions and figures of the species in their general appearance as well as in characters of the dictyonal skeleton.

In pl. XXIV, figs. 13—15, are represented the two best preserved of the specimens. In the specimen shown in two views in figs. 13 and 14, the body which has lost the attachment base, is of a swollen conical shape, 24 mm. high and 26 mm. broad in the broadest parts; the wall as thick as 9 mm. in the thickest parts; the irregularly funnel-like gastral cavity opening at the broader body end with an oval main osculum of about 12 × 18 mm., without taking into the measurement the sinuous foldings into which the oscular rim is thrown. The other specimen, shown in fig. 15, is somewhat vase-like, being of an elongate conical shape, 34 mm. high and 18 mm. wide across the broader upper end.

The wall of the central gastral cavity exhibits a number of roundish or oval openings leading out into the parietal tubes. The pumice-like gastral surface passes gradually or roundedly into that of the tubes, without forming a sharp edge around the openings. These may measure

up to nearly 5 mm. across, and are separated from one another by an interspace which may be about as wide or considerably wider.

On the external side the sponge wall shows numerous irregular pit-like, or meandering and anastomosing gutter-like, depressions, generally 1.5—3 mm. in width. The depressions are separated from one another by a firm partition wall 1—2 mm. thick. Some of the more deep pit-like depressions reveal themselves to be radial parietal tubes by the fact that they internally communicate with the central gastral cavity by the openings before mentioned; the others are intercanals, which are, as a rule, closed towards the gastral cavity. Much irregularity as well as complication in appearance of the two canal systems are caused by the unequal development of the partition wall, at different places by its inclination or curvature one way or the other, and by the frequent formation of bridge-like connections over canal spaces by the meeting and fusion of the bounding walls with their outer edges. The bridging over occurs alike over intercanals and across external opening of parietal tubes, though more frequently in the former situation.

As was pointed out by F. E. Schulze, the parietal tubes originate by the originally plate-like sponge-wall becoming folded and drawn out into tubes open at the outer end. The various stages of their formation are plainly represented at and along the deeply folded oscular rim. In the specimen represented in fig. 15, the several parietal tubes are still simple and either stand out quite separately or are in an early stage of uniting at certain points of their wall edge to form arch-like bridges over intercanal passages.

While usually the intercanal is open only towards the exterior, it occasionally communicates internally with the central gastral cavity by means of simple apertures through the bounding plate of the latter, — a fact which has not been recorded before. The apertures would be indistinguishable from those others on the gastral surface which lead into parietal tubes, if only their edges were drawn out externally in a tubular manner. As simple apertures, they have come to be situated in the deep parts of a valley-like concavity as the adjoining parts have become raised into parietal tubes, i. e., in the intercanal. None the less, I believe, they are to be considered to represent parietal or accessory oscules together with the openings at the outer end of parietal tubes. The part of the intercanal with a simple parietal osculum opening into it, may be said to combine the nature of a parietal tube in physiological respect. The occurrence of such a part makes it difficult to draw a sharp line of distinction between the two canal systems.

The dictyonal skeleton, of which good figures were already given by Bowerbank (1869) and F. E. Schulze (1887), presents some very characteristic features (pl. XXIV, fig. 16). Meshes triangular, quadrangular of irregularly polygonal, considerably varying in size. Beams 30—62 μ thick, 150—412 μ long, cylindrical, beset with numerous transverse rows of small conical tubercles. Nodes joined by usually more than six (up to about ten), and less frequently by six or five beams; considerably swollen, though sometimes scarcely thickened at all; the thicker nodes provided on surface with a varying number (2—8 or more) of broad and tubercled wart-like prominences. All the superficial nodes on both dermal and gastral surfaces are thus warty on the external side, but never exhibit freely projecting peg-like rays as in most other dictyonine species, — a very noteworthy negative character to which attention was duly called

by F. E. SCHULZE. More deeply situated nodes generally less prominently warty, or, as is not infrequently the case, wartless and simple. Observations on the condition of the axial threads show that the nodes contain each the center of a hexactine or pentactine dictyonal spicule, besides being joined, in most cases, by the outer ends of rays or beams coming from other, immediately adjacent nodes. Occasionally a beam is seen to come into junction with another, in the course of the latter.

The Siboga specimens of *M. callocyathus* have no trace of the loose spicules preserved.

2. *Myliusia verrucosa* n. sp. (Plate XXIV, figs. 17—19).

Stat. 97. 5°48′.7 N., 119°49′.6 E. 564 m. 3 specimens.

Diagnosis. — Small, moderately thick-walled, irregularly tubular cup. Externally quite uneven, on account of irregular radial outbulgings between which are intercanals. Numerous roundish accessory oscula (up to 2 mm.), at intervals of 1—4 mm. on both outbulgings and depressions. At places radial canals and intercanals scarcely distinguishable.

Dictyonal beams with nearly uniformly distributed tubercles, at places showing inclination towards rather ill-defined arrangement in transverse rows. Isolated spicules not known.

Description. — Three small specimens, of which two are shown in figs. 17 and 18 from station 97 (near Pearl Bank in the Sulu Archipelago), are identified with *Myliusia* and are here made to represent a new species, closely resembling in appearance but apparently distinguishable from *M. conica* (O. Schm.) (= *Scleroplegma conicum* O. Schm. of the West Indies, O. SCHMIDT, 1880, pl. VIII, fig. 4).

Specimen A (fig. 17) is an irregular tubular cup, laterally compressed and with compact attachment base on one side of the somewhat narrowed inferior end. Height 21 mm.; transversely 9 mm. by 13 mm. at the upper end. Main osculum at the upper end of a lobate or indented outline, 4—5 mm. across, leading into a deep central gastral cavity. Cup wall 1.5—4 mm. thick, perforated by numerous accessory oscula of 1—2 mm. width, these opening at end of parietal outbulgings as well as in depressed positions between the outbulgings of the surface. Intervals between the openings from less than 1 mm. to about 4 mm. The latter evidently represent intercanals between the outbulgings, but cannot always be easily distinguished from radial canals, since certain accessory oscula bring the two into intercommunication and the intercanals into direct communication with the gastral cavity in much the same way as all the radial canals communicate with that cavity.

For *Myl. conica* (O. S.) it was given by F. E. SCHULZE that the radial canals are generally directed somewhat obliquely upwards and outwards. This sort of arrangement cannot be noticed with any distinctness in any of the short canals contained in the wall of the present species. Further, both O. SCHMIDT and F. E. SCHULZE have distinctly given to understand that in the above mentioned W. Indian species the radial canals stand separated throughout by septal wall from the intercanals which should be open only on the outer sponge surface. From the agreement of their figures with the specimens before me I rather doubt if this is the exact condition, but am inclined to assume that the canalization is probably essentially the same as in the present species.

Specimen B (fig. 18) probably represents only the lower parts of an individual. At the inferior end is a short stalk-like attachment base. The sponge body, so far as it is represented in the specimen, shows on the quite uneven external surface a number of roundish apertures 1.5 mm. or less in diameter. These lead internally into labyrinthine passages, which in the upper lost parts of the sponge probably united themselves into a central gastral cavity. — Specimen C (not figured) is a fragment, probably from the lower body parts of an individual. In gross structure it compares well with the last mentioned specimen.

As all the specimens were found to be completely washed-out skeletons, I can give only a description of the dictyonal frame-work. This is essentially similar to that of the species already known of the genus. Dictyonal meshes commonly triangular, 130—300 μ in length of sides. Irregularities in the formation of the reticulum most frequent on the gastral surface of the wall. Beams generally 35—70 μ thick, profusely tubercled; the tubercles rather coarse, conical, nearly uniformly scattered, or as is not infrequently the case, showing inclination towards being arranged in transverse rows. Nodes distinctly swollen, commonly 110—165 μ across, provided on surface with several microtubercled wart-like elevations; frequently sending out small, slender spikes. The nodes in the bounding surfaces of the wall were never found to bear an outwardly directed spike; this may be due simply to their having fallen off by breakage. The same nodes usually show the tubercled warts in largest numbers on the external side.

From *Myl. callocyathus*, *M. verrucosa* differs markedly in macroscopic appearance, so that there can scarcely be a doubt as to the distinctness of the two species.

The species here described as new differs from *Myl. conica* (O. Schmidt) in the tubercles of dictyonal beams being less prominent, in their being pointed to a lesser degree, and in their being nearly uniformly distributed (though sometimes with some show of an arrangement in transverse rows), instead of being distinctly disposed in single-file transverse rows, as F. E. Schulze represents in his figure (Chall. Rep., pl. CI., fig. 2). After all, however, I must say that there seems to exist a very close resemblance between the two forms in the above characterization as also with respect to their macroscopic structure.

Family Tretodictyidae F. E. Sch., 1886, s. restr.

Tretodictyidae partim, F. E. Schulze, 1886, p. 78; 1877, pp. 327, 398.
Tretocalycidae partim, F. E. Schulze, 1904, p. 179. — Schrammen, 1910—12, p. 222.
Auloplacidae partim, Schrammen, 1910—12, p. 191.

Scopularia with extensively developed schizorhysis. Interschizorhytic skeletal framework of a structure essentially similar to that in the Farreidae or the Euretidae. Scopule apparently always present.

The Tretodictyids are quite or moderately thick-walled sponges of a habitus varying from goblet-like or expanded-funnel-like to bent-plate-like, to being like a mass of branched and anastomosing tubes or rods, or to being of a dendritic appearance.

The most prominent feature of the family lies in the development of an extensive system

of schizorhytic canals. The canals commonly run longitudinally on the whole, arranged side by side and close together; but sometimes they take indefinite directions and may then appear at first sight not unlike a system of intercanals between branched and anastomosing outbulgings of the sponge wall. The dictyonal framework may be essentially of the same structure as in the Farreidae, though on the whole somewhat less uniformly and regularly quadrangular in the shape of meshes; at other times it fairly agrees with that of certain Euretids in exhibiting triangular meshes and multiradiate nodes in numbers. Dermalia and hexaster are about as various as in the Euretidae. Both scopule and uncinate seem to be constantly present.

Here again I deem it preferable to give an annotated list of the genera rather than to attempt drawing up a differential key to them.

Genera of the Tretodictyidae.

1. *Tretodictyum* (F. E. Sch., 1886) Schram., 1910–12. Tubular or cup-like, with dermalia pentactin to subpinular-hexactin. Oxyhexaster only, like that of *Farrea*. Genotype: *T. tubulosum* (F. E. Schulze, 1886).
2. *Hexactinella* Carter, 1885. Expanded-bowl-like to cup-like or spatulate. Discohexaster either alone or in company with oxyhexaster. Genotype: *H. ventilabrum* Cart., 1885.
3. *Auloplax* F. E. Schulze, 1904. With hexactinoid discohexaster only. Possibly identical with *Hexactinella*. Genotype: *A. auricularis* F. E. Schulze, 1904.
4. *Cyrtaulon* F. E. Schulze, 1886. In addition to ordinary scopules there occur peculiar scopule-like needles, of which one end is swollen and bears a radiating tuft of slender branches, each ending with a marginally toothed disc. Hexaster unknown. Genotype: *C. solutus* F. E. Schulze, 1886.
5. *Tretocalyx* F. E. Schulze, 1900 *d*. Thick-walled cup, with only hexaster in the form of hexactinoid onycohexaster. Genotype: *T. polae* F. E. Schulze, 1900.
6. *Sclerothamnopsis* H. V. Wils., 1904. Dichotomously branched and anastomosing stock with oscula on sides and at end of branches. Dermalia hexactin with swollen and pinulately developed distal ray. Long-principalled oxyhexaster, either alone or in association with long-principalled lophodiscohexaster. Genotype: *S. compressa* H. V. Wils., 1904.
7. *Sclerothamnus* W. Marsh., 1875. Like the above but with pad-like spiral or annular elevations on surface. Some scopule with transverse processes on shaft and with terminal branches frequently strongly divergent and bent backwards. Small floricome-like tylohexaster common. Only species: *S. clausi* W. Marsh., 1875.
8. *Psilocalyx* n. g. Thick-walled cup with wide labyrinthic schizorhysis opening, both dermally and gastrally, by wide roundish or irregular-shaped apertures. Most external dictyonal beams and the spikes unusually thickened and uniformly thickly tubercled. With long-principalled lopho-tylohexaster. Only species: *Ps. wilsoni* n. sp.
9. *Anomochone* n. g. Irregularly funnel-like showing tendency to branch, or subglobose; with terminal osculum and smaller lateral oscula. Dictyonal skeleton commonly showing triangular meshes and multiradiate swollen, berry-like nodes. Genotype: *A. expansa* n. sp.

Genus **Tretodictyum** F. E. Schulze, 1886, emend.

Tretodictyum partim, F. E. Schulze, 1886, p. 78.
Hexactinella partim, F. E. Schulze, 1887, pp. 327, 398.
Tretodictyum A Schrammen, 1910—1912, pp. 223, 225.

In 1886 F. E. Schulze introduced the genus *Tretodictyum* with three species under it, viz., *T. tubulosum*, *T. latum* and *T. cyathus*. In the Challenger Report the last named species was recognized to be identical with Carter's (1885) *Hexactinella ventilabrum*; consequently the generic name *Tretodictyum* was given up in favour of the older name of Carter, so that the two first mentioned species now received the names of *Hexactinella tubulosa* F. E. Sch. and *H. lata* F. E. Sch. respectively. Schrammen, in 1910—1912, proposed to generically separate *H. ventilabrum* from these two, for which, as also for the two fossil species of his discovery, he revived F. E. Schulze's old generic name *Tretodictyum*. I entirely concur with him in the opinion that *Tretodictyum tubulosum* can well be held up in distinction from *Hexactinella* s. restr. with *H. ventilabrum* for genotype. From the Siboga collection I have been able to add to the genus *Tretodictyum* two more living species, which will directly be described under the names of *T. schrammeni* and *T. pumicosum*. To the genus probably belongs the fragment from Galli Island, Mediterranean Sea, which was figured by F. E. Schulze (1900, Mittelmeer Hex.) and which that author doubtfully referred to *Hexactinella*, holding it to be perhaps identical with his *H. tubulosa*. If the two fossil species described by Schrammen (l. c.) from the Upper Cretaceous of north western Germany, *Tretodictyum loeschmanni* and *T. pfaffi*, were correctly identified as regard the genus, cannot be satisfactorily verified.

Genus *Tretodictyum* as made up of the three living species indicated, may be characterized as follows:

Stock consisting of stump-like or tubular processes which may develop into a complex of branches with anastomoses. Externally covered all over by dermal layer. Small oscula opening at end or on surface of the processes or branches, and leading each into a pit-like or a cloaca-like gastral cavity. The several gastral cavities are not directly continuous but by intervention of the diarhysial canal system which pervades the entire stock. Skeletal septa in the form of branching trabeculae or plates connected together by anastomoses as well as interseptal dictyonal bridges and singly running beams. Dictyonal beams with tubercles either scattered or arranged in transverse rows. Dermalia pentactin or hexactin; in the latter case the distal ray may be weakly pinulate. Scopule with rough end-prongs without bulbous swelling at end. Hexaster in the form of oxyhexaster with prolonged principals. Rhaphidial uncinate present.

The genus appears to be a near ally of *Hexactinella* emend., with which it agrees to a certain degree in skeletal structure and in the condition of diarhysial canals, though differing widely in the habitus of stock and in the hexaster being the oxyhexaster of a special type instead of tylohexasters. *Sclerothamnopsis* H. V. Wils. is apparently another near ally of the genus. Besides the fact that it resembles especially *T. schrammeni* n. sp. in the shape of stock, the two genera are in possession of strikingly similar oxyhexaster and scopule, while the pronounced pinulate development of hexactin dermalia in *Sclerothamnopsis* may be regarded as a character which is incipiently foreshadowed in *Tretodictyum*, in as much as in the latter; the dermalia, instead of being exclusively pentactins, are occasionally hexactins with a short peglike

distal ray, or are even all hexactins in which the distal ray may be of a weakly pinulate development (as in *T. pumicosum* n. sp.).

1. *Tretodictyum tubulosum* F. E. Schulze, 1886. (Plate XIX, figs. 1—4. Textfig. 24.).

Tretodictyum tubulosum F. E. Schulze, 1886, p. 78. — Schrammen, 1910—1912, p. 226.
Hexactinella tubulosa F. E. Schulze, 1887, pp. 328, 398, Pl. XCIII. — H. V. Wilson, 1904, p. 83 (sp.?).

Stat. 95. 5°43′.5 N., 119°40′ E. 522 m. 1 fragment.
China Sea, 17°44′ N., 110°26′ E. 216 m. MACLEAR LADDS coll.

Diagnosis. — From an encrusting common part arise subcylindrical stumpy, 10—15 mm. thick processes with rounded end and terminal osculum up to 6 mm. in diameter. The processes may grow into a dichotomously dividing system of branches, some of which anastomose; sometimes they may take the form of a thick irregular ridge or plate with several oscula on the edge or on its one surface. Gastral cavities pit-like but of a limited depth, not directly continuous with one another but through the general diarhysial canal system of the stock. This canal system consists of intercommunicating sinuous, slit-like spaces (in most places about 1 mm. wide) between and around septa. The septa occur in the axial parts as longitudinally running columns; these send out branches radially and at the same time obliquely directed from inside below towards outside superiorly. The branches divide a few times and may broaden towards the end, thereby often assuming an irregularly folded plate-like form. Seen on dermal sponge surface the truncate outer ends of septa usually appear as irregular, often branching or meandering threads of some length and about as wide as, or somewhat less wide than, the intervening cleft-like canal spaces which are externally covered over by the dermal layer. Dictyonal beams with microtubercles, nearly uniformly distributed, though at places showing a slight tendency to an arrangement in transverse rows. Dermalia are rough oxypentactins of varying dimensions. Dermal scopules large and strongly developed, over 800 μ long with finely but densely barbed, nearly parallel or but little divergent end-prongs; those of gastral and septal surfaces with much more weakly developed parts. Oxyhexaster about 100 μ in average diameter, with usually two strongly divergent terminals to each slender principal which is about as long as the terminal it bears.

Description. — The above diagnosis I have drawn up from my observations on specimens of the species from Sagami Sea. As the original description given by F. E. SCHULZE in the Challenger Report does not quite fulfill our requirements in many respects, it may not be out of place here to record a little more of the organization than is contained in the diagnosis.

The entire external surface of the stock — the truncate outer ends of septa as well as the interjacent diarhysial clefts — is covered by a continuous dermal lattice of a delicate appearance, of which the meshes are mostly square. A corresponding covering layer is not present on the gastral wall. The several gastral cavities may be regarded as cloaca-like, local expansions of the general diarhysial canal system, each opening externally by an osculum. The cavity may be 10 mm. or thereabout in depth. Its lateral wall appears fluted, owing to the exposed inner edges of longitudinally running septa. The septa are seen in this position, as in all other parts of the sponge, sometimes to split into two which run nearly parallel side by

side and sometimes to send out a branch which, after an oblique course, soon joins a neighbouring septum; besides, there exist at varying intervals relatively thin interseptal connectives running transversely across the interjacent space. So that, the gastral cavity shows on the wall a number of longitudinally elongate oval or slit-like openings, by which it freely communicates with interseptal diarhysial canals. Inferiorly the gastral wall contracts until finally the gastral cavity as such is no longer recognizable. Only so long as it exists the subcylindrical body may be said to be tubular with thick wall and a central lumen; but below the point where it has ceased to exist, the transverse section of body shows in all its parts only an assemblage of septal columns and plates in cross-section, separated from one another by an irregularly reticulating system of interseptal slits, without these expanding into a wide central space as they do in the tubular parts of the body.

In the skeletal septa a set of continuous dictyonal strands is seen to run longitudinally, following the course taken by them. The other set, in the deeper parts of body, runs in the main so as to rectangularly intersect the former, thus giving rise to meshes more or less square in shape and measuring up to 275 μ in the length of sides. At the outer end of septa the meshes are of quite an irregular shape. External spikes are elongate conical and strongly developed, reaching $^1/_8$ mm. or more in length; those on septal and gastral surfaces are of a weaker development. Dictyonal beams are 35—100 μ, in some specimens up to 130 μ, thick. They are provided on surface with microtubercles which are nearly uniformly distributed but may show at places a slight tendency towards arranging themselves in transverse rows. However, at no place is this arrangement so distinctly carried out as in *T. schrammeni* or in *Hexactinella? spongiosa*.

The dermalia are rough oxypentactins of varying dimensions and strength. The distal (sixth) ray is usually represented by a swelling, but may sometimes take the form of a peg-like rudiment with rounded tip. A large dermalia may have paired rays 400 μ long and 40 μ thick at base, which dimensions in the smaller ones may run down to 115 μ and 6 μ respectively. The unpaired proximal ray is usually longer than, frequently fully thrice as long as, the paired ray in the same spicule. All the rays are beset all over with microtubercles, though somewhat more sparsely than in *T. schrammeni* (pl. XX, fig. 2).

The dermal scopule is very strongly developed and may be 825 μ long. The head (pl. XIX, fig. 3) consists of usually 4, sometimes only 2, straight or very slightly curved, and nearly parallel or but little divergent prongs, up to 110 μ long. These may be unusually thick or but moderately so, are thickly beset with very minute barbs, and end with a scarsely distinguishable terminal disc. In a very strongly developed dermal scopule the prongs may reach 10 μ in thickness in the basal parts, whence they taper gently towards the tip. The shaft bears in the greater part of its length weak, proximally directed spinules.

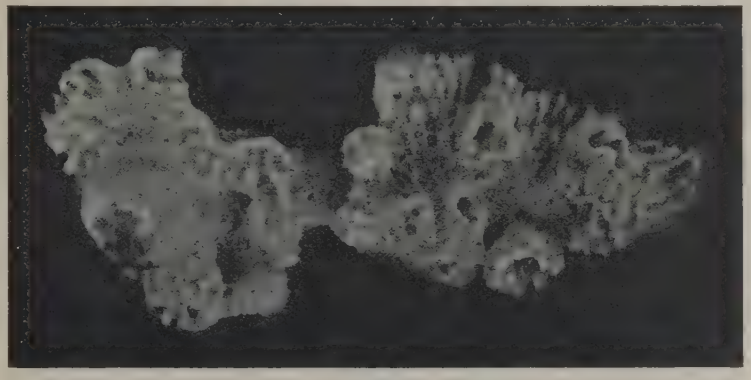
The gastral scopule and that which occur on the surface of septa are similar to the dermal, though on the whole much weaker (pl. XIX, fig. 2). They have parts at the most only moderately strongly developed, without ever reaching the stoutness attained by some of the dermal scopule.

The oxyhexaster (pl. XIX, fig. 1) is of the type with prolonged principals and strongly divergent terminals. In one specimen it measured 81—116 μ, in another 96—143 μ, and in still

another 108—143 μ in diameter. The average diameter may be put at about 100 μ. Usually two terminals occur to a principal which is about as long as they are. Occasionally the spicule is met with in the form of a hemi-oxyhexaster or even a monoxyhexaster.

The uncinates seem to be all of rhaphidial thinness. They may measure up to 715 μ in length, are about 2 μ thick in the middle, and taper nearly uniformly towards both ends. They are almost smooth, or may show a weak barbation (pl. XIX, fig. 4) or just an indication of barbation in the form of minute bracket-like incisions. The uncinates occur very numerously in loose bundles, mostly in radial arrangement with their outer end at or near the dermal surface of body.

Tretodictyum tubulosum has hitherto been known only from Japan. In the Siboga collection there is a small and completely water-washed fragment, which, so far as the dictyonal skeleton goes, tallies well with *T. tubulosum* and may provisionally be identified with that species. From China Sea (S. of Hainan) there is now before me a moderately well preserved specimen (textfig. 24) which, without doubt, belongs to the species. It is one of the Hexactinellids which were obtained by Mr. Maclear Ladds from a reclaimed marine cable and were kindly given me by Dr. Hanitsch of the Raffles Museum in Singapore.



Textfig. 24. — *Tretodictyum tubulosum* F. E. Sch., collected by Mr. Maclear Ladds in China Sea. Seen from above. Natural size.

The China Sea specimen consists of an elongate crust-like mass by which it was evidently attached to the cable, and from which project above a number of somewhat irregularly boss-like and tubular prominences, in part fused together with their sides and each with an osculum at end. Stocks of essentially the same habitus are in my hand from Sagami Sea. In certain parts of the basal expansion, diarhysial canals show themselves under the dermal lattice as straight and parallel running, deep grooves, alternating with vertical wall-like septa, both extending from base of certain tubular protuberances right to the free edge of the expansion. In other parts of the sponge the diarhysial canals appear in superficial view as irregular mesh-like spaces inclosed by, or as more or less sinuous spaces between, external ends of septa.

Of the spicules I limit myself to making the following statements: Dictyonal beams generally 50—100 μ thick, with microtubercles rather irregularly distributed and scarcely ever tending to an arrangement in transverse rows. Dermalia reach 500 μ in length and nearly 50 μ in basal thickness of paired rays; distal ray represented by a knob or a peg, which, in some of the smaller dermalia, may be prolonged to a considerable length. Dermal scopule (pl. XIX, fig. 3) with head made up of usually 4, seldom 2 or 5, prongs up to 100 μ long and 10 μ thick in the basal parts. Gastral and canal scopule (pl. XIX, fig. 2) more slender, and with shorter (as short as 50 μ) and relatively more expanding head consisting of 5—9 prongs. Oxyhexaster (pl. XIX, fig. 1) 81—115 μ in diameter; occasionally 3 terminals to a principal; rarely hemihexasteroid and hexactinoid. Rhaphidial uncinate numerous (pl. XIX, fig. 4).

2. *Tretodictyum schrammeni* n. sp. (Plate XIX, figs. 15—19; Plate XX, figs. 1—8. — Textfig. 25).

Stat. 251. 5° 28′.4 S., 132° 0′.2 E. 204 m. Fragments.
Stat. 259. 5° 29′.2 S., 132° 52′.5 E. 487 m. 1 fragment.
Stat. 262. 5° 53′.8 S., 132° 48′.8 E. 560 m. Fragments.
Stat. 267. 5° 54′ S., 132° 56′.7 E. 984 m. Fragments.
Stat. 297. 10° 39′ S., 123° 40′ E. 520 m. Numerous fragments.

Diagnosis. — Stock consisting of branches up to 11 mm. thick, which divide dichotomously and frequently anastomose so as to form wide meshes. Numerous patulous oscula up to 4 mm. in diameter, situated in a row on one side of the branches and those of the same stock all turned in the same direction; the rest of the external surface showing pores of various sizes and continuously covered over by dermal layer. Gastral cavities are shallow spaces, one within each osculum, and appear as mere local widenings of the general diarhysial canal system between septa. Septa in the form of radial columns extending from the surface obliquely inwards and downwards, their inner ends joined together into a longitudinally disposed axial columella. Dictyonal beams with tubercles arranged in transverse rows. Loose spicules essentially as in *T. tubulosum*, but the dermalia more pronouncedly rough on surface, the scopule more weakly developed in its parts, and the oxyhexaster with terminals longer than principals.

Textfig. 25. — *Tretodictyum schrammeni* n. sp. The largest piece obtained by the Siboga at Stat. 297, seen from the oscular side. Natural size.

Description. — At station 297, off the south-western end of Timor, were obtained a number of variously sized fragments which are made the type of this new exquisite species. The two largest of them are shown in textfig. 25 and in pl. XIX, figs. 15 and 16 in two different views. Station 262, west of Great Kei Island, has also yielded some moderately large fragments, which, though all in a completely water-washed condition, may safely be referred to the present species. The same may be said of the single small fragment from Stat. 259, also to the west of Great Kei Island. Further, there are some more small fragments from Stations 267 (east of Great Kei I.) and 251 (south of Kur I., Banda Sea), which are all, except one from the former locality, much too bleached or otherwise incompletely preserved for exact observation. The piece excepted has retained some loose spicules and could therefore be determined as tallying well with the type from Timor in essential points of spiculation.

The large Timor-specimen shown in the accompanying textfigure consists of a number of dichotomously dividing and anastomosing branches, which lie not all in one plane but some behind others. There exists at a point of one of the lateral borders (the left border in the figure) a broad attachment process, which is probably an adventitiously produced one, and not the real base of the stock, which seems to be unrepresented. The second specimen shown in pl. XIX, figs. 15 and 16 is a similar but smaller branch, broken off in all probability from one and the same stock as the first. In this specimen all the dichotomously produced forks lie nearly in one plane. The general shape of the original stock, of which these specimens formed parts, presumably resembled that of *Sclerothamnus clausi*; the several branches arising from a common base and forming an erect and bushy complex which, there is reason to believe, was so flattened as to present two broad opposite faces. One of these faces should have been distinguished, as will soon be shown, by having all the oscula of the stock opening on that side. The dichotomous division of the branches takes place several — at least 5 or 6 — times, at varying, though on the whole, wide intervals. The forks form a wide rounded angle. The branches fuse together where one incidentally comes into contact with an other, and this may take place at their tip or at a point in their course. The anastomoses thus effected bring about inclosed mesh-like spaces of a radially elongate, oval or irregularly oblong shape, varying from 12 × 7 mm. to 38 × 18 mm. in size.

The branches are not quite cylindrical but slightly flattened, so that their cross-section is of a somewhat oval outline, varying in diameters from 11 × 8.5 mm. to 8 × 6.5 mm. at different parts of the stock. At no place are the branches so thick as in *T. tubulosum*, in which they may be 15 mm. thick. The flattening occurs in the same sense as that of the stock, that is to say, the shorter diameter is directed vertically to the faces of the latter. The tip of freely ending branches is irregularly rounded. As a rule no terminal osculum is to be found there.

The oscula (textfig. 25; pl. XIX, fig. 15), of which there are a great many, are relatively large, simple, roundish or oval, sharp-edged openings, generally 2.5—4 mm. in diameter. Their occurrence is confined to one face of the flattened branches, and all oscula in the same stock open in the same direction; so that one may distinguish oscular and aboscular aspects of the branches as also of the entire stock. The oscula are arranged on the branches in an irregular longitudinal row with intervals of varying length (up to 8 mm.) between them. The row runs generally in the median line of the branch face, though at places it may approach nearer one edge than the other. As a rule the oscula open flush with the sponge surface; only exceptionally the margin is so produced outwards as to form a low ring-wall around the oscular opening.

Besides the oscula there are numerous other apertures of a smaller but varying size, distributed all over the sponge surface. They are all those which, in the unabraded condition of the surface, should be covered by the dermal layer. They can readily be distinguished into two categories, those which are comparatively large and others which are much smaller (pl. XIX, figs. 16, 19). The former are of a roundish or a somewhat more irregular outline, measuring usually 0.5—2 mm. across, and are distinctly seen to lead internally into the diarhysial canal system. They lie sometimes pretty close together, at other times in a much more scattered distribution. The latter occur crowdedly together and are mostly nothing else than superficial dictyonal meshes themselves, and in part entrances into small recesses of the choanosome. The

large and small apertures here in question cause a porosity of the surface which is much like that of the pumice. Also in its rigid but brittle nature the sponge may well be compared to that object. It is considerably more firmly built than *T. tubulosum*.

The dermal layer is preserved only here and there on the specimens. It extends in close contact with the choanosomal surface and also continuously over many of the entrances into the diarhysial canal system. As already indicated, I assume that, in the perfectly intact state of the surface, it will be found to cover all the external apertures except the oscula, exactly as in *T. tubulosum*. In pl. XIX, fig. 19, which represents the aboscular surface of the branch magnified twice, the delicate supporting lattice-work of the layer — best seen with the aid of a hand-lens — will be distinctly observed in remnants, but still entirely covering up some of the larger apertures present on the side. The lattice-work shows meshes of a size just discernible with the naked eye; they are not always regularly square but more generally rectangular, triangular or trapezoidal in shape, varying 330—600 μ in the length of sides.

Here may be recorded the observation which seems to show that the oscula, under certain circumstances, may become secondarily covered over by an extension of the dermal layer. Such closed oscula were met with in some number, limited in their occurrence to the basal, and therefore the older, parts of the branches. Possibly the closure stands in relation to the decreased activity of those parts of stock in the taking in and giving out of the water.

The sponge branches are in no part strictly tubular. Internally, instead of being traversed by a single axial lumen, they are pervaded by a system of intercommunicating diarhysial canals. These are interseptal, slit-like spaces 1 mm. or over in width, the course and arrangement of which are determined by the course and shape of the septa. The septa may be described as consisting of a thin, axially running columella-like part, from which arise numerous, elongate and invertedly pyramidal radial septa, directed obliquely upwards and outwards; or conversely, as made up of the radial septa which, with their thinned inner ends, join together longitudinally and thus form the axial columella. In cross-sections of the branch the septa generally present a more or less triangular shape with one of the angles pointing axiad, while lateral interseptal spaces appear as radial slits confluent into a central space (pl. XIX, fig. 18). This central space is longitudinally traversed by the columella, which is however practically never quite free all around, but is joined in its course, now to this and now to that septal cross-section at the internal end. Frequently in a transverse section of the sponge branch the dictyonal tissue of the columella may be seen to be joined to two or more consecutive septal sections at once, and so to close up the interjacent radial space or spaces at the inner end, due to the septa concerned, arising close together from the columella; but in other cross-sections that immediately follow or precede, the same spaces will be found internally open and the columellar tissue to be in junction with some other septum or septa. Taking in all, it may be said that there exists a common peri-columellar space into which all the radial spaces are confluent. — In longitudinal sections of the branch passing through the axis, the radial septa present themselves on both sides of the columella as obliquely disposed, elongate plates narrowest at the infero-internal end which forms the columella and gradually widening towards the end at the external sponge surface, while the canals show themselves on either side oblique slits, alternating with the septa (pl. XIX, fig. 17). The slits here seen in supero-internal and infero-external relations to each and every

septum, and the radial slits that we have seen laterally to each and every septum in transverse sections of the branch, are plainly different sections of a continuous space extending all around the length of a septum. Since the same space is a direct radial extension of the aforementioned pericolumellar space, it is clear that all the spaces constitute in reality a system extending continuously throughout the entire sponge body. — The gastral cavities, of which there is one within each osculum, are nothing else than local widenings of the above canal system, situated on the oscular side of the sponge branch. They may be about half as deep as the branch is thick at the part, and are commonly about as wide as, or slightly wider than, the oscular opening belonging to them. The gastral wall is uneven and not well defined, exhibiting, as it does, some gaps between exposed septal edges, by means of which gaps the cavity stands in direct communication with the canal spaces all around as well as below the bottom on aboscular side.

The radial septa are joined together at a few and isolated points of their internal surfaces and edges by slender connective beams which cut the shortest route in passing from one septum to another across the interjacent canal space. Furthermore, the septa are connected together at their external or dermal edge by a thin superficial sheet of dictyonal tissue, with gaps which, were it not for the presence of the covering dermal layer, would bring the internal canals, the diarhysis, into direct communication with the external world.

Spiculation. — The dictyonal skeleton is made up of beams which vary considerably in thickness in different parts and are beset on surface with an abundance of small conical tubercles, for the most part distinctly arranged in transverse rows (pl. XX, fig. 1). Robust elongate conical spikes with rounded tip project from superficial nodes of the dermal surface. They are of a varying length, up to nearly 300 μ long. The tubercles on them are densely crowded in the distal parts, but more proximally assume an arrangement in transverse rows, much as in *Myliusia* and *Aulocystis*. The spikes on the wall of internal canals are much smaller and feebly developed, being generally under 165 μ in length, spine-like or finger-like, often swollen at end, and nearly uniformly tubercled on surface.

Seen on the external surface of the sponge, the dictyonal network is quite irregular. The beams there are generally 100—160 μ (though at places nearly 200 μ and occasionally only 40 μ) thick; the meshes are mostly irregularly roundish, oval or roundedly triangular with longest diameter of 150—500 μ or more. In the deeper parts the beams are on the whole thinner, measuring generally 40—90 μ across, while the meshes are mostly more or less regularly square with sides of 150—450 μ. This regularity in shape of the meshes is due to the latticework being formed of vertically intersecting beam strands, of which one set runs longitudinally in the septa, gently curving outwards in its obliquely upward course from the columella superiorly towards the dermal surface (pl. XIX, fig. 17). Here and there on the septal skeleton are found medium-sized regular hexactins (with rays about 165 μ long) attached to a beam by one of their slender rays. Such hexactins without doubt represent the structural units of the dictyonal framework.

The dermalia are rough pentactins of very widely varying dimensions (pl. XX, figs. 1, 2). A large and strongly developed dermal may have paratangential rays 550 μ long and 60 μ thick at base, whereas a very small one may have same less than one-third as long and only

about 8 μ thick. There exist all sorts of intermediate sizes between the extremes. Several instances of very large dermalia, lying with their paratangentials over and outside those of much smaller ones, were observed. This shows that there is no ground for regarding the former as hypodermalia in distinction from the latter as autodermalia, strikingly different though they be in dimensions. The proximal ray is about as long as the paratangentials in the same dermalia; sometimes it was found to be even somewhat shorter than the latter, and in no case was it observed so markedly prolonged as in *T. tubulosum*. The atrophied distal ray is sometimes scarcely indicated; more frequently it is represented by a low swelling or by a peg-like rudiment. A few cases of pinulate hexactins with a short pinulately developed ray (pl. XX, fig. 2*d*) were met with in the preparation, but I am not quite sure if they really belonged to the specimen. The paratangential rays of the dermalia present a very slight curvature convex on the outside. All the rays taper more or less gradually toward the pointed end. Fine microtubercles occur all over the surface in more or less dense distribution, the tuberculation being most pronounced on the larger pentactins.

The scopules are of one kind, though those of the gastral and canal surfaces are slightly larger than those of the dermal surface (pl. XX, figs. 3—5). Dermal scopule 540—570 μ in total length, the end-prongs 65—70 μ long. Gastral and canal scopule 600—715 μ in total length, the end-prongs 80—90 μ. Shaft in both 5 or 6 μ thick in the thickest part close to origin of the prongs. The shaft is smooth, except at the inner end which is faintly rough. The end-prongs at the other extremity number 4—6, seldom 7, to each scopule, forming a tuft of an elongate-conical shape. The prongs are moderately strong, and never so very strong as in *T. tubulosum*. They are thickest at base, where they show a slight curvature. For the rest of their length they are nearly straight. Except in the basal parts which are smooth, the prongs are faintly rough, which roughness increases in distinctness or may even assume the appearance of a minute barbation towards the terminal disc. This disc is quite small and inconspicuous; so that, unless a high power of the microscope be used for observation, the prongs may appear to terminate almost abruptly without it. The scopule occurs but sparsely on the dermal side; it is more numerous on gastral and canal surfaces, being quite common at certain places of these.

Long and slender oxea-like uncinates, reaching $1^2/_3$ mm. in length and 6.75 μ in thickness, occur in abundance in the sponge periphery, lying in vertical orientation to the dermal surface (pl. XX, fig. 1). They not infrequently form strong and compact bundles. Under a low power of magnification they appear to be smooth throughout. In fact the barbs are scarcely ever developed; however, there are on the surface an abundance of the little grooves which, in ordinary uncinates, are to be found one below each barb (pl. XX, fig. 3). These grooves give to marginal edges of the spicule an appearance of being incised like bracket-steps on a flag-staff. Smaller uncinates, 240—500 μ or more in length and down to about 3 μ in thickness, are present in deep parts of the sponge in sparse and isolated distribution. These exhibit also only an obsolete trace of barbation, when examined under a high power of the microscope.

Oxyhexasters are common in the choanosome. They are of the long-principalled type, the same as those which occur in other species of the genus and are characteristic to *Farrea*. Diameter 85—115 μ. Principals 15—25 μ long; each with 2 or 3, strongly divergent terminals, 23—38 μ long.

3. *Tretodictyum pumicosum* n. sp. (Plate XIX, figs. 8—14).

Stat. 260. 5° 36′.5 S., 132° 55′.2 E. 90 m. 4 specimens.

Diagnosis. — Stock small, tuberous or consisting of basal part from which arise tubular prominences, not over 6 mm. thick and each with a terminal osculum. The prominences may anastomose. Each osculum leads into a pit-like gastral cavity. External sponge surface rudely reticular, with mesh spaces under 1 mm. width, representing entrances into intercommunicating diarhyses between skeletal trabeculae. Dictyonal framework small-meshed, the meshes not over 150 μ wide; beams thin, not thicker than 43 μ, with irregularly scattered microtubercles on surface. Dermalia oxyhexactins in which the distally directed free ray may be weakly pinulate. Scopule mostly like that of *T. schrammeni*, up to 660 μ long and with rather slender end-prongs; sometimes thickly developed and in appearance much like dermal scopule of *T. tubulosum*. Oxyhexaster like that of *T. tubulosum*, 55—77 μ in diameter, with terminals about as long as, or shorter than, the principal.

Description. — This new species was obtained by the Siboga at her Station 260, to the west of Great Kei Island. It is represented by four small, and therefore probably young, specimens, of which the one shown in pl. XIX, fig. 8 is the only one with loose spicules and may be made the type of the species. From the basal part, which is attached to a piece of coral, arise several tuberous or tubular prominences, not more than 6 mm. thick and ending each with a small osculum. At one place, two neighbouring prominences have joined and fused together, forming an arch. The stock, if left to grow, might have assumed a habitus much like that of *Tretodictyum tubulosum* but made up of less thick parts. The oscula are of an irregular or lobate outline, measure 1.5—3 mm. across, and lead each into a pit-like gastral cavity which extends deeply into the sponge and ends without directly communicating with others of the stock. All over the exterior of the sponge are numerous, mostly roundish or oval, diarhysial apertures about 1 mm. or less wide and separated from one another by reticulating, compact septal surface of 0.5—1.5 mm. width. The external appearance of the sponge wall is closely like that of *Anomochone globosa* n. sp. (pl. XIX, figs. 20—24). The tubular wall, up to nearly 2 mm. in thickness, consists in the upper parts of reticulating septa in a single layer, being perforated by simple radial diarhysial gaps. Towards the thickened basal parts of the stock, the septa assume the character of a three-dimensional reticulum and the wall a cancellated structure, showing in its thickness more than one meshes, representing intercommunicating diarhysial spaces of the wall.

In the protected parts of the surface, the external diarhysial openings — in fact the external sponge surface — is seen to be covered over by the delicate dermal lattice. There can be no doubt whatever that that state of things originally existed over the entire sponge, exactly as we know it to be the case in *Tretodictyum tubulosum*. A corresponding gastral covering, the gastral lattice layer, does not exist, so that the diarhyses open freely on that side. The gastral wall presents the same rudely reticular appearance as the external sponge surface after loss of the dermal layer.

The remaining three specimens of the species are all in a completely washed-out condition. The best preserved of these is shown in natural size in pl. XIX, fig. 9. It consists of a common base attached to a coral, and of two irregularly shaped bodies which have approached each other

and fused in the upper parts. Each has more than one small and indistinct osculum on the top. All the specimens agree well with the type in macroscopic appearance as well as in the characterization of the skeleton.

Spiculation. — The skeletal trabeculae consist of a dictyonal framework with unusually small meshes and slender beams (pl. XIX, fig. 14). The former measure generally not more than 150 μ wide, and are not of uniform shape, being but seldom square or rectangular. The latter are only 43—27 μ, mostly about 35 μ thick. They are provided on surface with conical microtubercles which are irregularly scattered and nowhere very numerous. Thickly microtubercled, elongate-conical spikes of about 200 μ length arise on the dermal surface from the most superficial nodes. Those projecting from septal surface into internal spaces are of similar development.

The dermalia are rather weak-rayed oxyhexactins with rays only about 4 μ thick at base and with the free distal ray shortest of all (pl. XIX, figs. 13, 14). Paratangential rays 100—140 μ long; proximal ray about as long as, or much longer than, paratangentials of the same spicule; both tapering from base to tip and with a sparse number of obsolete, obliquely outwardly directed spines on the greater part of their length. Distal ray 65—100 μ long, tapering only near the outer end, and with an increased, though varying, number of slightly better developed spines in the outer half of its length. When the spines are rather large and numerous, as they sometimes are, the ray may be said to be nearly pinulate. Rarely it is club-like with rounded end, measuring only about 30 μ in length. Canalaria and gastralia do not seem to occur.

The scopule, 520—660 μ in length, varies much in thickness of parts (pl. XIX, figs. 10, 11). The more slender ones look very much like the dermal scopule of *T. schrammeni*, the thicker ones like that of *T. tubulosum*. In general, the shaft is nearly smooth or may be finely rough; the end-prongs number almost constantly 4 and are but weakly divergent. They are commonly 50—85 μ long and 4 μ or thereabout in thickness at base, but not infrequently thickened to about 8 μ; their surface is thickly covered with minute barbs; the tip bald, rounded without swelling, as in other species of the genus. There seems to exist no important difference between scopules of the dermal and the gastral side.

The oxyhexaster is common. It is of the same type as that of other species of the genus, having greatly prolonged principals, each of which bears 2, less commonly 3, strongly divergent, terminals about as long as, or slightly shorter than the principal they belong to. The oxyhexaster is small, measuring 54—77 μ in diameter; the principals are 14—21 μ long in different spicules.

Uncinates of rhaphidial appearance, generally 350—550 μ long and about 4 μ thick in the middle, are numerous, mostly radially disposed in the sponge periphery. The barbation is quite obsolete, being represented at the most by minute bracket-like indentations. Much larger uncinates, 13 μ thick and provided with well developed barbs, were met with in a few instances in the preparations.

Remarks. — The most characteristic features in the spiculation of this species lie in the relatively thin-beamed and smaller-meshed dictyonal skeleton and in the hexactin nature of the dermalia. The latter character seems to be one which is not without its indication in *T. tubulosum* and *T. schrammeni*, in that in both the dermalia, though usually pentactine, may occasionally be hexactin with short distal sixth ray. At the same time, the hexactin dermalia

of *T. pumicosum* may be regarded as one of the links which bring the genus into connection with certain other Tretodictyid genera in possession of exquisitely pinulate, hexactin dermalia. Amongst such genera *Sclerothamnopsis* seems to be the most nearly related genus to *Tretodictyum*, the two having oxyhexasters of the same type, besides resembling each other in the habitus of stock.

Genus **Hexactinella** Carter, 1885.

Hexactinella Carter, 1885, p. 397. — Schrammen, 1910—1912, p. 223.
Hexactinella partim, F. E. Schulze, 1887, pp. 327, 398. — H. V. Wilson, 1904, p. 77.
Tretodictyum partim, F. E. Schulze, 1886, p. 78.

Of the several recent species which have been ascribed by authors to the genus *Hexactinella*, some should in my opinion be transferred into other genera.

These are:

H. tubulosa (F. E. Sch., 1887) was made by A. Schrammen (1910—1912, p. 223) into a *Tretodictyum*, in which procedure I concur. — *H.* sp.? F. E. Sch. (1900 *b*), from Galli I., Mediterranean Sea, held by the describer to be perhaps identical with *H. tubulosum*, is in all probability to be placed under *Tretodictyum*. — *H. filholi* Tops. (1904 *c*), while not satisfactorily retainable in the genus, agrees so well in all respects with *Auloplax auricularis*[1]) F. E. Sch. (1904), that the two may be regarded specifically identical. — *H. monticularis* v. Ldfd. (1915) is surely a form which should have been generically associated with *Tretocalyx polae* F. E. Sch. (1900 *b*) instead of with *Hexactinella*. — Further, *H. labyrinthica* H. V. Wils. (1904) is still another form which, I think, may well be separated from Hexactinella, chiefly from considerations of its stock habitus and gross structure. In those respects it seems to agree essentially with *Tretodictyum*, though the difference in the sort of hexaster lies in the way of taking it up into that genus.

After elimination of the above forms, the list of living *Hexactinella* species hitherto known, becomes reduced to *H. ventilabrum* Carter, 1885 (the genotype), *H. lata* (F. E. Sch.) 1886, *H. grimaldii* Tops., 1890, and *H.* sp. *indet.* v. Ldfd., 1915. To these will be added in this report *H. rugosa* n. sp., *H. vermiculosa* n. sp., *P. lingua* n. sp. and *H.*? *spongiosa* n. sp. from the Siboga collection. If the genus, even in this new scope given it, can long be held up without further emendation, is not a little questionable. As to the fossil species, *H. angustata* and *H. laevis*, described by Schrammen (1910—1912) from the Upper Cretaceous of N. W. Germany, it can only be justified to have the querymark placed after the generic denomination, as I have done for *H.*? *spongiosa* n. sp.

The genus *Hexactinella*, in the scope given it by me, may be diagnosed as follows:

Expanded-bowl-like, changing to plate-like or to an irregularly lobate and folded shape; or vase-like and either simple or branching. Externally covered all over by dermal layer; internally with gastral layer, but with numerous small excurrent-apertures. Choanosomal skeleton forming

---

1) This is a form which, in its turn, may possibly be generically or even specifically identical with *Dactylocalyx*? *patella* F. E. Sch. (1887, p. 350), as F. E. Schulze himself has remarked (1904, p.. 48). Again, the latter is a form which was held by the same author (1887, p. 403) to be perhaps identical with *Joanella compressa* O. Schmidt (1880, p. 55). It seems to me the possibility is not very remote that *H. filholi* may have to be called after all by the generic and specific names last mentioned.

radial septa vertical to sponge surfaces, or in the form of cancelli-like trabeculae. Diarhyses intercommunicating interseptal or intertrabecular spaces, slit-like or labyrinthine. Dictyonal beams with conical microtubercles in scattered distribution or arranged in transverse rows. Dermalia either pentactin or hexactin with short distal ray. Scopule with finely rough end-prongs, not bulbously swollen at end. The common hexaster is a tylohexaster with much prolonged or only moderately long principals; a second smaller form of tylohexaster with short principals may occur in addition. Oxyhexaster present or not present. Rhaphidial uncinates always present in abundance, nearly smooth or with an abortive indication of barbation.

Before going into the description of the *Hexactinella* species in the Siboga collection, it may not be out of place to briefly put down, for the sake of comparison, the results of my own studies on the genotype, *H. ventilabrum* Cart. and also on *H. grimaldii* Tops.

Hexactinella ventilabrum Cart.[1]). — The body, at an early stage of development, is shaped like a laterally compressed bowl, with wide gastral cavity forming a through-like groove at bottom; on extensive growth the wall broadly spreads out and is thrown into irregular, radial wavy or plait-like folds, which often give rise to tubular or funnel-like formations with gastral surface outside and dermal surface inside. The body may attain a width of 70 cm. or more, and the wall a thickness of 10 mm. The dermal surface is covered throughout by the continuous dermal lattice; the gastral surface shows numerous exhalent apertures of varying size, the largest (up to 4 mm. in diameter) occurring in a linear series along the through-like fundus of gastral cavity. The sponge is light, very fragile, and when held against light, admits internal septa and interjacent diarhysial canals to be clearly seen through.

As seen from the exterior of the sponge, the canals in the major part of the wall appear as parallel interseptal slits (up to 1 mm. across) running in the main radially in baso-marginal direction, and the intervening skeletal septa as narrow bands, not wider than the canals. The bands are seen here and there during their course towards the margin to divide at small angles and thus to increase in their number. Between them there exist, at indefinite intervals, relatively inconspicuous connections by means of cross-beams which take the shortest cut in traversing across. In lateral view, i. e., as seen on radial sections of the sponge wall, each septum appears as a band-like plate with incisions, extending more or less deeply from both its dermal and gastral edges in an oblique direction towards the median line of septum and the sponge base. In other words, each radial septum consists of short branches separated by incision-like gaps and arranged in two series in a plane, vertical to both the sponge surfaces; all the branches, after an obliquely internally and basally directed course, coming with their inner ends into junction with one another in a longitudinal tract midway between the surfaces. The incisions or gaps, referred to, effect the intercommunication of every two neighbouring interseptal canals. The dictyonal tissue of septa is made up of longitudinal and transverse fibers, the former gently curving from the longitudinal median tract outwards and into the septal branches of either side. The meshes formed by the intersecting sets of fibers are, as observed under the hand-lens,

1) *H. ventilabrum*, Carter, 1885, p. 397; pl. XIV, figs. 1—10; F. E. Schulze, 1887, p. 331; pl. XCVI. — *Tretodictyum cyathus*, F. E. Schulze, 1886, p. 79.

almost regularly square, measuring 300 μ or more in the length of sides. Altogether the radial sections of the sponge wall presents essentially the same appearance as the longitudinal section through axis of a branch of *Tretodictyum schrammeni* (pl. XIX, fig. 17).

On the dermal side of the wall the interseptal canals are, in water-washed specimens, open throughout their length and are therefore groove-like, though in the intact state they will be found entirely and continuously covered over by the dermal lattice. Towards the sponge base the interseptal connectives increase not only in frequency of occurrence, but also in the quantity of dictyonal elements entering into their composition, until, at the stalk-like base itself, they are no longer distinguishable from septal branches and the two together form a cancellated-like structure, which, on the external surface, appears as a reticulum of septal walls with irregular pit-like meshes rather, than as being made up of prolonged septa and interjacent groove-like clefts. The skeletal parts here form a sort of cancelli, the spaces of which are intercommunicating diarhyses.

On the gastral side of the wall the parallel edges of longitudinally running septa are connected together by a thin and flatly extending dictyonal layer, the continuity of which is, however, interrupted by numerous large and small roundish apertures freely opening through it. These are of course excurrent apertures for the outflow of water from the diarhysial canal system. The apertures are in part very small; others, excepting the largest in a line at the bottom of the gastral cavity, are 1—2 mm. in diameter and fairly uniformly and closely distributed. At places, but especially in the marginal region, the apertures may be closely arranged in longitudinal series in correspondence with the longitudinal interseptal canals of which they are the gastral openings, thus revealing more or less distinctly the course of the septa themselves. The larger apertures are frequently seen to lead into a shallow space, which shows at the bottom free edges of a septum or two, i. e. stands in connection with more than one interseptal canal at once. The largest apertures (up to 4 mm. in diameter) in a linear series along the trough-like gastral fundus lead into deep, pit-like canals, which as they penetrate into the stalk-like base, communicate with the diarhysial spaces of the region.

Dictyonal fibers (generally 30—100 μ thick) are provided with tubercles irregularly distributed. — Dermalia and gastralia are moderately large pentactins, usually with a swelling in place of the lost sixth ray. Occasionally the swelling may be developed into a short peg-like form. The unpaired ray, imbedded in the body wall, is about as long as the paired paratangential ray. Scopules and uncinates are as given in the generic diagnosis; the former with 3 or 4 end-prongs. — Long-principalled tylohexasters, 58—70 μ in diameter, are common. Principals 17—21 μ long; terminals shorter, 12—17 μ long, about 10 in number to each umbel which is of a conical shape. — A second form of tylohexaster, about as large as the smallest of the last kind or smaller and with short principals, bearing each a smaller number of long terminals, occurs less commonly, though at places it may be almost as numerous. — Oxyhexaster of a similar shape occurs still less commonly. It measures 58—89 μ in diameter; the principals about 10 μ long, each bearing 2—4, much longer terminals.

Habitat: Sagami Sea, 500 m. From the Gulf of Panama and the Galapagos. H. V. Wilson (1904, p. 82) has reported a form which was however doubtfully identified with the species.

Hexactinella grimaldii Tops. [1]). — For the gift of a well preserved specimen of this species I am indebted to the kindness of Professor E. Topsent. It is probably one of those which were collected by the "Travailleur" in the Atlantic, north-west of Spain from a depth of 1916 m. From Topsent's descriptions as well as from my own observations on the above specimen, I have drawn up the following notes on the species.

Cup-like at first, but later acquiring, by continued growth of only a part of the wall, the shape of a lobe-like plate which spreads out more or less horizontally and may show double curvatures like those of a shoehorn. The wall may attain a thickness of 7 mm. Diarhysis in the form of intercommunicating canals vertical to dermal and gastral surfaces, making the choanosome appear cribellated when seen by transmitted light. The external entrances, covered over by the dermal lattice, into the canals are roundish or somewhat irregular in shape, measuring 1 mm. or under in diameter; the open exhalent apertures on the gastral surface vary in shape from roundish to oblong, may measure up to 2 mm. long by 1 mm. wide, and are arranged in linear disposition radially towards the free margin of body. The above condition of the diarhysial system is readily derivable from that in *H. ventilabrum* by assuming a stronger and more numerous development of interseptal dictyonal connectives throughout the body in the present species. Much the same state of skeletal structure we have seen in *H. ventilabrum* itself but restricted to the basal parts of body.

The dictyonal framework is irregularly meshed. The fibers generally measure 35—85 μ in thickness and are weakly microtubercled on surface without regularity. — The dermalia are rather strong sword-like hexactins up to 1.5 mm. in length of radial axis, with nearly smooth distal ray, swollen into a club-like shape and greatly prolonged proximal ray. — The gastralia are similar but smaller hexactins up to 600 μ in length of radial axis. — Scopules slender, 460—800 μ or more in total length, with usually two, 55—135 μ long, nearly straight, little divergent and minutely rough end-prongs with small terminal disc. — Long-principalled tylohexaster common, 75—162 μ in diameter; each 25—58 μ long, slender and distally attenuating principal bearing at the end a small and narrow umbel of 3 or 4, extremely fine and slightly outwardly curved terminals which end each with an obsolete, sometimes quite indistinct, terminal knob; the umbel usually not longer than $^1/_3$, and frequently only about $^1/_4$ as long as the principal bearing it. No other hexaster form seems to occur. — Together with the above tylohexaster free simple microhexactins are of common occurrence. These are not hexactinoid oxyhexasters, as attested to by the fact that the axial canal invariably extends right to the end of rays. Amongst them may be included some such as arose from the long-principalled tylohexaster by the mechanical breaking off of the terminal umbel. There have come under observation several cases of small hexactins in which some of the rays still bore remnants of damaged terminal umbels, indicating that all the six rays are to be looked on as hexaster principals. However, there seems to be no ground whatever to ascribe this mode of origin to all the microhexactins in question. — The uncinates, which occur in great abundance, are slender, barbless and obsoletely rough or nearly smooth. The longer ones (Topsent's "soies diactinales") may reach 600 μ in length; they are, I think, normally straight, but may be found in a bent state. The smaller sort (Topsent's "microxes droits") is 39—65 μ long or longer.

Habitat: Azores, 1300 m.; N. W. of Spain, 1916 m. (Topsent).

1) Topsent, 1890; Ditto, 1892, p. 34; Ditto, 1904*d*, p. 195.

1. *Hexactinella lata* (F. E. Schulze, 1886). (Plate XVIII, figs. 1, 2).

Tretodictyum latum F. E. Schulze, 1886, p. 79. — Schrammen, 1912, p. 225.
Hexactinella lata F. E. Schulze, 1887, pp. 329, 399; Pls. XCIV and XCV.

Stat. 251. 5° 28′.4 S., 132° 0′.2 E. 204 m. Fragments.
Stat. 254. 5° 40′ S., 132° 26′ E. 310 m. 1 fragment.

Diagnosis. — Dichotomously branching, strong-walled tubes, 1—4 cm. in diameter, expanding at oscular end in funnel-like form. Diarhysial canals appear to run generally in longitudinal direction, uniform in breadth, here and there dichotomously branching, opening externally into subdermal space by longitudinal clefts and internally into gastral cavity by similar or roundish apertures. Skeletal septa between the canals radially and longitudinally disposed, frequently undulating or meandering, made up of predominantly square-meshed dictyonal framework, in which one system of continuous beams runs from the inside obliquely towards the exterior and upper parts of the sponge. Dictyonal beams beset with small tubercles arranged for the most part in transverse rows. Dermal pentactin with bottom-like or peg-like rudiment of the lost distal ray. Gastral pentactin similar to dermal, but less strong and with the rudiment of the freely projecting sixth ray somewhat longer. Scopule with quadrituberculate thickening at the shaft end whence arise 4, slightly divergent, rough end-prongs knobbed at end. Hexasters are tylohexaster and oxyhexaster. The former with moderately long principals, each of which bears a bell-shaped umbel of 2—6 terminals gently bent **S**-like and knobbed at end; sometimes hexactinoid ("sphaerohexacts"). The latter, which occurs but rarely, has short principals and thin long terminals. Uncinates of various strength present. — Type specimens obtained by the Challenger near the Little Kei Island, 140 fms. (Chall. Stat. 192, 5° 49′ 15″ S., 132° 14′ 15″ E.).

The above brief description of the species is based entirely upon F. E. Schulze, but I have given my own interpretation to the nature of the canals in the wall and to that of the peculiar "sphaerohexact".

Description. — In the Siboga collection there are some completely macerated fragments which may be ascribed to the species, though the imperfect state of preservation necessarily makes the identification not thoroughly satisfactory. They hail from Station 251 and 254, both which localities are not very far distant from where the Challenger obtained the type specimens.

From Stat. 251, northwest of Tajandu Is., Banda Sea, there are several small pieces, of which the largest is shown in pl. XVIII, figs. 1 and 2. To judge from the curvature, it may have originally formed a part of a funnel-like wall about 50 mm. in diameter. It is 3 mm. or under in thickness. Another fragment, presumably from a more basal part, is 5 mm. thick. Still another fragment, probably a part of a tubular wall of about the same breadth as one's finger, includes a portion of the oscular margin, which is thinned out to a moderately sharp edge.

The skeletal wall (pl. XVIII, figs. 1, 2) may roughly be described as being cancellated and spongy. The irregular areola-like cavities in the wall are diarhysial in nature; they intercommunicate with one another and freely open externally as well as at certain positions of the internal gastral surface, although in the original intact state of the sponge a continuous covering layer may have existed on both the surfaces (dermal and gastral layers).

The skeletal parts which divide the wall cavities may be distinguished into the longitudinal

septa and the interseptal connections. — As seen on the external side of the skeletal wall (fig. 1), the longitudinal septa, which constitute the more conspicuous parts of the skeleton, appear as irregular, long and narrow plates of varying thickness (0.5 mm. or less to about 1 mm. thick), disposed radially with their width and running lengthwise parallel to one another, with intervening spaces (up to about 1.5 mm. wide), considerably wider than the septal thickness between them. They take an irregularly sinuous course. Sometimes a longitudinal septum in its upward course splits into two, which run side by side; at other places it may be seen to obliquely join an adjacent one. Viewed from the lateral side, the septum shows itself, not as an uninterrupted wall of uniform height, but as being frequently broken in its continuity by relatively wide gaps in the form of either perforations or of deep indentations which cut into it from the external edge obliquely in basal direction. In other words, there exist to each of the septa a long continuous strip, bordering the gastral surface, from which strip arises at short intervals a series of short and irregularly column-like or plate-like processes directed externally but generally slightly inclined towards the oscular end; the gaps between the septal processes are either open or closed at the dermal end, in which latter case the processes concerned form an arch or a perforated crest. The gaps bring the interseptal spaces into lateral communication with one another. — Structually the longitudinal septum consists in the main of rectangularly intersecting dictyonal beams, one set of which runs quite longitudinally along the gastral septal edge, and obliquely longitudinally in the septal processes in conformity to the inclined state of these. The meshes are predominantly square. The beams are beset with tubercles which are arranged in complete transverse rows. In this respect the skeleton closely agrees with that of *Hexactinella rugosa* n. sp., *Tretodictyum schrammeni* n. sp. and *T. spongiosum* n. sp., but differs from that of *H. ventilabrum*, in which the beam tubercles are scattered. Tuberculated spikes of various length project from superficial nodes as usual. At certain superficial positions, hexactins with lank tubercled rays, joined to one another in quite an irregular manner, are found in ankylosis to dictyonal framework, as in the skeleton of allied forms.

The interseptal skeletal connections are relatively thin and insignificant structures, consisting, as they generally do, of either isolated dictyonal beams or irregular lattice-girder-like, simple combinations of dictyonal hexactins. They may occur quite superficially, bridging over the external septal edges, or at a deeper position right in the canal-like interseptal spaces, running not always strictly transversely but sometimes obliquely. They are found at such irregular intervals in the course of interseptal spaces that these are incompletely devided into irregularly honeycomb-like cavities about as long as, or considerably (up to twice or several times) longer than, they are wide. All the wall cavities are freely open on the external side of the skeletal wall, denuded of the covering dermal layer. How they open on the internal side will soon be described. Owing to the longitudinal septa which are more conspicuous than the interseptal connections, the wall cavities and their external openings appear for the most part arranged in longitudinal series (fig. 1). Since the successive cavities in the same series are by no means completely partitioned by the narrow interseptal connections, and since those on either side of a longitudinal septum stand in communication with one another by the septal gaps before mentioned, all the cavities in the skeletal wall are intercommunicating spaces, at least so in the state of the sponge deprived of all the soft parts.

On the gastral surface (fig. 2) the skeletal wall presents a markedly different appearance to what is seen on the dermal side. Here the same dictyonal tissue as that which we have seen making up the skeletal septa, runs in superficial longitudinal bands of varying breadth. In their upward course, the bands frequently divide dichotomously, and are about as frequently joined together by their lateral expansions. They are at places only about 0.75 mm., at other places 2 mm. or considerably over, in breadth. Between the bands are openings, usually about 1 mm. wide and varying in shape from roundish to longitudinally elongate and cleft-like. The openings are arranged in longitudinal lines, corresponding to the course of the canal-like interseptal spaces, of which they are the gastral apertures. Several openings may sometimes appear to lie very closely approximated in a longitudinal linear series, a condition which is brought about by a long cleft being traversed crosswise, at intervals and at the level of the gastral surface, by simple or lattice-girder-like dictyonal beams, the same as the interseptal connections before described. At other places, consecutive openings of the same series may be separated by a considerable tract of reticular dictyonal tissue, formed by the gastral edge of septa expanding laterally into a layer so as to bridge over the interseptal space at the place. Tracts of the same nature sometimes extend for a considerable length along certain interseptal spaces, closing these for that length on the gastral surface. It is these tracts of dictyonal tissue which, in the gastral view of the skeletal wall, present themselves as superficial, longitudinally running, dichotomously branching, and frequently anastomosing dictyonal bands (fig. 2). The above described relation of parts can readily be demonstrated by viewing the wall against light.

It will be noticed that the above described structure of the skeletal wall stands in essential agreement with what is said by F. E. Schulze of *Hexactinella lata* in the Challenger Report.

Close to the thinned oscular margin, a part of which is represented in one of the fragments in hand, the skeletal wall consists of a dense-meshed dictyonal tissue, and shows, besides being perforated right through by small apertures, no sign of a cancelated or canallated structure.

A few delicate oxyhexasters with long principals, and some scopules with unknobbed end-prongs were met with in the preparations, but they may be disregarded, as being objects surely foreign to the fragments under consideration. As attested to by the swollen state of axial canals in the dictyonal beams, the sponge must have been long dead before it was taken up by the trawl, and so could scarcely have preserved such loose spicules of its own.

At Stat. 254, east of Tajandu Islands, the Siboga also obtained an irregular-shaped fragment, which in structural regards closely agrees with F. E. Schulze's figure (1887, pl. XCIV, fig. 2) of a macerated skeleton of the species. It is difficult to judge from the piece what the form of the original stock may have been, or what part of this it was torn away from. The dictyonal beams exhibit signs of corrosion but have preserved in some parts the tubercles arranged in transverse rows.

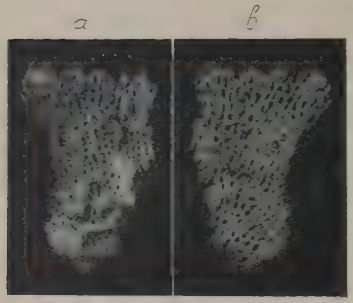
2. *Hexactinella rugosa* n. sp. (Plate XVIII, figs. 7—10. Textfig. 26).

Stat. 260. 5° 36′.5 S., 132° 55′.2 E. 90 m. Fragments.

Diagnosis. — Shaped presumably like a cup or a vase with more or less outwardly

expanding wall. Dermal surface partly rugged on account of the presence of irregular ridge-like prominences, which consist of a dense dictyonal tissue. Except in that respect, the wall is of essentially the same structure as in *Hexactinella ventilabrum* or *H. lata*; only, both longitudinal skeletal septa and interseptal diarhysial clefts are distinctly narrower, measuring generally only 0.5—0.75 mm. across, and both external and internal apertures of the clefts much smaller. Scopule with 4 smooth, slenderly tapering and obsoletely knobbed end-prongs. Other loose spicules not known.

Description. — This new species is based on about half a dozen plate-like fragments obtained at Stat. 260, to the west of Great Kei Island. One of the largest pieces is shown in pl. XVIII, fig. 7, 8; another, in textfig. 26. Unfortunately all are in a washed-out state. The shape of the original sponge cannot be definitely made out, but presumably it may have been cup-like or vase-like. The size must have been moderately large. The double curvature exhibited by the larger fragments indicates that the wall, at the same time as it surrounded the gastral cavity, was expanded outwards, probably more or less like a funnel.



Textfig. 26. *Hexactinella rugosa* n. sp. A fragment from Stat. 260, in dermal (*a*) and gastral (*b*) views. Natural size.

While the wall is fairly even on the gastral surface (pl. XVIII, fig. 8; textfig. 26*b*), the dermal surface is in part strikingly uneven or rugged, owing to the presence of irregular prominences or reticulating ridges (pl. XVIII, fig. 7; textfig. 26*a*). The thickness of the wall, in the intervals between the ridges, is in the marginal parts about 2 mm. or less, but increases to about 4 mm. farther below. Where the external ridges are prominently developed, the wall thickness may run up to 6.5 mm. The ridges may reach about 3 mm. in breadth and are made up of a rather compact dictyonal tissue of a uniform appearance. Apart from them, the skeletal wall distinctly exhibits its composition out of irregular longitudinal septa and of interseptal connections. The arrangement of these is essentially the same as in *Hexactinella ventilabrum* or as I have described for the Siboga specimen of *H. lata*. Only, the septa and the intervening longitudinal clefts, which both measure generally only 0.5—0.75 mm. across, are distinctly narrower, and the cross-connections over or in the same cleft occur less widely apart from one another, than in those species; the consequence being that the apertures on both wall surfaces are much similar. The apertures are about as long as wide or but little elongate in longitudinal direction. On the external wall surface (fig. 7), a part of the internal canals is covered over by the external ridges of dense dictyonal tissue; in the depressed spaces not so covered, the apertures give to the surface a reticular appearance with meshes (i.e. the apertures) showing more or less a tendency to a linear arrangement along the course of longitudinal septal edges. The gastral surface of the wall (fig. 8) is of much the same reticular appearance. The septal edges are slightly thicker on this side than on the external. The zones of band-like dictyonal layer, which we have seen in *H. lata* to close certain interseptal clefts for some length on the gastral side, do not seem to exist, so that the longitudinal septa, apparently each and all, expose their gastral edge on the surface.

The dictyonal framework is of a delicate nature. Its meshes in the septa are mostly

approximately square, measuring 120—210 μ in length of sides. In certain parts, but especially in the external parietal ridges, the framework is much closer and quite irregularly meshed. The beams, usually 30—50 μ thick, are beset with numerous conical tubercles, which are rather coarse and tend to be disposed in incomplete transverse rows (pl. XVIII, fig. 9). The nodes, which are usually sexradiate but may sometimes be multiradiate, are but little swollen. Rather strong and long, densely tubercled spikes arise from superficially situated nodes.

Of the loose spicules, I have discovered a fair number of small and peculiarly characterized scopules (pl. XVIII, fig. 9), held among the dictyonal tissue. They are 400—590 μ long. The end-prongs, 45—65 μ long, number 4 to each spicule; they are nearly straight, finely tapering distally, smooth on surface, and minutely and obsoletely knobbed at end. I have scarcely a doubt that the scopules belong to the species.

Less certain am I if the few uncinates which were met with in certain preparations, also belong to the species. They are strong ones, measuring 1.5 mm. long and 27 μ thick in the thickest parts, and densely provided with rather robust and obliquely directed barbs.

Of other spicules which were casually found in some preparations, I may mention the pinules and micramphidiscs of a certain Amphidiscophora, the characteristic branch-bearing scopule of *Sclerothamnus*, etc.

Remark. — In spite of the very imperfect knowledge that could be acquired of the loose spicules, I think the species may safely be placed under the genus *Hexactinella*. Probably it is a near ally of *H. lata* (F. E. Sch.).

3. *Hexactinella vermiculosa* n. sp. (Plate XVIII, figs. 3—6).

Stat. 89. Near Kaniungan, E. coast of Borneo. 11 m. Fragments.
Stat. 90. 1° 17′.5 N., 118° 53′ E. 281 m. 1 fragment.

Diagnosis. — Known in plate-like fragments, about 6 mm. thick. With skeletal structure essentially as in the genotype (*H. ventilabrum*), but differing from it in the skeleton being generally much denser and firmer; in the slightly narrower diarhysial clefts of the dermal side, disposed in sinuous, partly radially and partly variously directed, parallel lines; in the much more thickly developed superficial dictyonal layer of the gastral side, perforated by roundish apertures leading into deep excurrent canals; in the tubercles on dictyonal beams showing a tendency to an arrangement in transverse rows. Loose spicules unknown.

Description. — The shore collecting at the Siboga Station 89, near Kaniungan on the eastern coast of Borneo, has yielded some dead plate-like fragments, which I was at first inclined to identify with *Hexactinella ventilabrum* Cart. of the Japanese waters, but after a comparative study I have decided to present as a distinct species under the name of *H. vermiculosa*. No information as to how they came to be obtained on the shore is available. A small macerated fragment taken up by trawl from a depth of 281 m. at Station 90, a locality not far distant from the above, belongs without doubt to the same species.

From the fragments in hand, of which the largest from Stat. 89 is shown in pl. XVIII, figs. 3—5, it may be assumed that they originally formed parts of the wall of an individual, either vase-like or of a more flatly expanded shape like *H. ventilabrum*. The piece figured comprises at one end a portion of the thick marginal edge; besides, it is gently bent so as to

be convex on the gastral side, indicating that the sponge had a flaring margin. A few centimeters from the margin the plate shows a thickness of 6 mm. The skeleton is light in the desiccated state, but is of a decidedly denser and firmer structure than in *H. ventilabrum*, crumbling between the fingers with less ease. It is moreover much less diaphanous, so to say. The internal canals and choanosomal septa cannot be discerned through the gastral dictyonal layer under reflected light, as they can be in the species just referred to.

The external or dermal surface of the skeletal wall (pl. XVIII, fig. 3) shows numerous irregular ridge-like edges of choanosomal septa, freely exposed as the result of the loss of the covering dermal layer. The edges are of varying thickness, from very thin to about 1.5 mm. thick. Between them are incurrent apertures of the diarhysial canal system, usually less than 1 mm. across and frequently more or less elongate and cleft-like. Compared with *H. ventilabrum*, the apertures are on the whole slightly narrower, while there exists no considerable difference in the thickness of septal edges. The longer cleft-like apertures are frequently crossed by narrow interseptal connections, which thus cut them into separate successive apertures of varying length, not rarely only about as long as wide. The canalar apertures are arranged in slightly sinuous lines, together with the septal edges alongside which they are ranged. Now, a striking feature of the species seems to consist in the fact that the said lines of apertures do not all and always run longitudinally in the baso-marginal direction, but frequently take, several adjacent ones together at a time, a distinctly deviating course, running at some places obliquely towards, and at some other places nearly or quite parallel with, the marginal edge of the sponge. So is brought about on the external side of the skeletal wall an appearance, which may perhaps be best likened to that of a closely worm-eaten piece of wood.

The dermal surface of the skeletal wall (pl. XVIII, fig. 4) is of a markedly different appearance. It may be described as being covered over by a superficial layer of dense dictyonal tissue, which is perforated by numerous, nearly uniformly distributed, excurrent apertures of round or roundish shape. The covering layer appears finely porous to the naked eye, and is more thickly developed than in *H. ventilabrum*, which fact stands in relation with the invisibility of the internal structure through the layer and also with the deeper and more pit-like development of the canals directly within the excurrent apertures. The apertures are mostly from about 1 mm. to nearly 2 mm. in diameter, being on the whole somewhat smaller than in *H. ventilabrum*. As in that species, they are scattered at intervals which may be about as wide as, but are not infrequently distinctly wider than, the apertures directly adjoining. Peering into the apertures, one sees the canal divide and communicate with the deeply situated internal spaces, and sometimes crossed in the deep parts by a septum, on both sides of which it opens externally by the clefts of the dermal side.

On cross-sections of the skeletal wall at right angles to the choanosomal septa, one sees the radially elongate, but not regularly shaped, sections of these, ranged side by side, leaving deep cleft-like interseptal spaces between every two of them. The external (dermal) ends are free, except when interseptal cross-connections that we have seen in the surface view of the dermal side, happen to be in the section. The deeper parts of the clefts seem to be nearly free of interseptal connections. The inner ends of the septa are connected together by the gastral superficial layer of dictyonal tissue, the continuity of which layer is broken only by the excurrent

canals penetrating right through it. This layer is very much thicker than in *H. ventilabrum*. It may constitute about one-fifth of the entire thickness of the wall, the remaining four-fifths being taken up by the radial height or breadth of the septa.

On wall sections, so cut as to expose to view a lateral face of a septum (Pl. XVIII, fig. 5), this presents itself as a very irregular and incomplete plate, with worm-burrow-like gaps in it, in the form of perforations and slits, the latter extending sometimes longitudinally, but more often so obliquely that they incline towards, and nearly come up to, either septal edge with that end which is directed away from the sponge base. It goes without saying that these gaps bring the interseptal canals into lateral communication with one another. The skeletal frame of the septa consists in the main of rectangularly intersecting strands of dictyonal beams, one system of which runs in part more or less longitudinally and in part obliquely in a definite way. Now, in most parts of the septa there exists a narrow middle zone in which the strands of the system, just referred to, may be said to run on the whole in the longitudinal direction though with casual variations and irregularities in their course which it would scarcely be worth while to particularize. That zone lies about half way between the external edge and the base of septa, or when we take the thickness of the gastral dictyonal covering into consideration, distinctly nearer the external septal edge than the gastral surface. From that middle zone and from its two sides, at short intervals, there deviate the dictyonal strands in branch-like groups, taking a gently curved and oblique direction in their outward course. The groups expand in breadth towards their end and so constitute the septal wall between the gaps, their obliqueness standing in relation with that of many of these. The strands of the groups on one side of the middle zone terminate at the external (dermal) septal edge, while those of the other side merge into the superficial dictyonal tissue of the gastral surface. Essentially the same structure of skeletal wall is observed in *H. ventilabrum*, but with this difference that in that species the middle zone runs nearly midway between the two surfaces instead of nearer the dermal surface, evidently in relation to the thin development of the covering dictyonal layer of the gastral surface. The lateral appearance of the septum in both *H. ventilabrum* and the present species, with its gaps and parts of dictyonal tissue, is closely similar to the appearance of the longitudinal section of certain *Tretodictyum* species (see pl. XIX, fig. 17).

The dictyonal strands or beams (pl. XVIII, fig. 6) are mostly 35—55 μ, seldom 75 μ, thick, as measured in the middle between nodes. They are therefore on the whole slightly weaker than in *H. ventilabrum*, and the thickness may reach up to 100 μ. On the other hand the rectangular or subquadrate meshes formed by them are on the average decidedly smaller than in that species, which fact seems to more than compensate for the weakness of beams in giving rigidity to the skeleton. The meshes measure generally 130—185 μ, seldom over 200 μ, in dimensions of sides, while in *H. ventilabrum* they range commonly from 200 μ upwards to 300 μ or even more in same. The beams are provided on surface with small conical tubercles. These are rather sparse and irregularly scattered on many fibers, though on certain others, especially on the stronger ones in exposed situations, they show an unmistakeable tendency to arrange themselves in transverse rows. This tendency is not observable in either *H. ventilabrum* or *H. grimaldii*.

As before indicated, I have no observation on any loose spicule of the species.

Nevertheless, from the far reaching agreement in the structure of the dictyonal skeleton, I think the species may confidently be assigned to the same genus as *H. ventilabrum*.

4. *Hexactinella lingua* n. sp. (Plate XVIII, fig. 11—17. Textfigs. 27, 28).

Stat. 251. 5° 28′.4 S., 132° 0′.2 E. 204 m. 3 specimens.
Stat. 262. 5° 53′.8 S., 132° 48′.8 E. 560 m. 1 specimen.

Diagnosis. — Moderately thick and somewhat wavy plate of a tongue-like shape, attached at one end by a relatively small basal disc. Dermal surface uneven, showing, when deprived of the covering layer, numerous, 1—2 mm. wide, deep, irregular pits and clefts which are separated by reticulating septal walls about as thick as, or thicker than, they are wide. Gastral surface comparatively even, pierced by a number of relatively small, oval or slit-like apertures which show a tendency to an arrangement in longitudinal lines. Dictyonal tissue to a great extent square-meshed, but irregularly reticulating and finely porous on exposed surfaces; beams in deep parts smooth or with scattered tubercles, those superficially situated thickly tubercled. Attached to septal edges at the entrance into dermal clefts are found snowflake-like dictyonal tissues, made up of small, irregularly spiny hexactins joined together in indefinite relation to one another. Scopule 385—650 μ long, with 4—7, little divergent, nearly smooth and obsoletely capitate end-prongs. Hexaster known in two small and delicate forms of tylohexaster: the one with short principals and widely divergent terminal umbels, about 40 μ in diameter, and the other with long principals and short and bell-like shaped terminal umbels. Rhaphidial uncinates present in abundance in the periphery, disposed vertically to external surface.

Description. — At Stat. 251, to the south of Kur Island in Banda Sea, were obtained three specimens on which I base this new species. Unfortunately we have here again to do with much water-washed fragments only.

The first specimen (pl. XVIII, figs. 11, 12) is an oblong tongue-shaped plate, rounded at one end and broken off at the other. Length 80 mm., greatest breadth 50 mm. The thickness varies much in different parts: about 10 mm. at the broken off end, and 3—7 mm. close to the natural marginal edge. One side of the plate is on the whole somewhat concave, which side I take for the dermal (pl. XVIII, fig. 11). The covering layer had been entirely washed away. The surface on the dermal side is deeply pitted and grooved. The grooves are irregular clefts, 1—2 mm. wide and up to 12 mm. long. The dictyonal mass between them forms irregularly branching and reticulating septal ridges, at places about as broad as, and at other places considerably broader than, the width of the clefts alongside. The ridges lie at unequal levels, whereby the surface is rendered quite uneven. They, and together with them the clefts, are seen to run on the whole obliquely across the plate. Frequently the septal ridge sends out laterally into the cleft short branch-like processes which end free, but which, if they grew on to the opposite septal ridge and fused with it, would have formed complete interseptal bridges like the many in actual existence. The origin of the processes may be traced back to local growth of the snowflake-like dictyonal tissue which is found commonly attached to the edge of septal ridges and gives to these parts a jagged appearance.

The slightly convex gastral surface (pl. XVIII, fig. 12) is comparatively even. It is perforated by relatively small apertures, mostly of an oval or a slit-like shape and showing a tendency to an arrangement in indistinct lines which run in part obliquely across the plate and in part more or less longitudinally towards its rounded natural end, in a direction which intersects approximately vertically that of the septal ridges on the opposite (dermal) side of the plate. The gastral apertures are usually 1 mm. or less, seldom nearly 1.5 mm. wide with a length varying from 1 mm. to 5 mm. They are generally oriented lengthwise in the line in which they are arranged. At places the apertures, or a part of them, are manifestly filled up by a growth of the dictyonal tissue, leaving behind their trace, either in the form of shallow superficial grooves or of streaks of the tissue, noticeably less compact than the surrounding parts. The band-like dictyonal tracts between the apertural lines are usually considerably wider than the apertures, measuring 1—5 mm. across.

Examining the plate on sectional faces, it requires no labour to ascertain that it consists of a gastral dictyonal layer, generally 1—1.5 mm. thick and perforated by the above gastral apertures, and of rudely reticulating septa which arise nearly vertically from the gastral layer, just mentioned, and which we have seen as ridges on the dermal side of the plate, conjointly with the pits and grooves. It can further be readily made out that the septa are incomplete walls with frequent gaps or passages through them, which bring all the interseptal clefts into lateral communication with one another. There thus exists in the plate a system of intercommunicating diarhysial canals, open externally on both its sides. The gross structure of the sponge wall may be said to be essentially the same as in *Hexactinella ventilabrum* or *H. vermiculosa*, but with differences in the details of the development of parts.

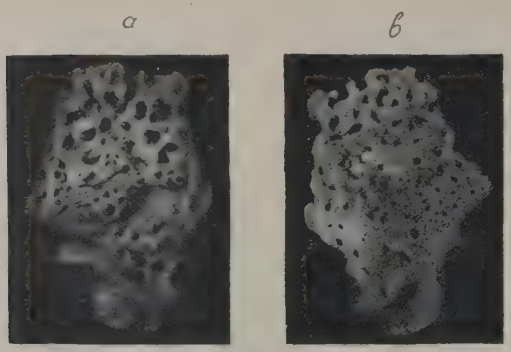
When studying the superficial surface by the naked eye, the dictyonal tissue in most parts appears densely porous. In the deeper parts prevails a different appearance in that the tissue there consists in the main of linearly continuous beams or of fibers, which intersect at nearly right angles and thus bring about the usual tesselate-like latticework. The same structure may show itself in certain parts of the gastral surface, but not with as much distinctness as in the more internal parts of the skeleton.

Textfig. 27. — *Hexactinella*? *lingua* n. sp. The second specimen from Stat. 251, seen on the dermal side. Nat. size.

The second specimen (textfig. 27) of the species is a similar but longer plate, bent like a boomerang and again broken off at the basal end. For the rest the marginal edge is preserved nearly intact. The plate is in the basal parts somewhat concave on the dermal side and convex on

the gastral, while in the more apical parts it is slightly bent the other way; so that in lateral view it exhibits a gently **S**-like curvature. The dermal side is quite rugged on account of some irregular prominences. It appears for the most part irregularly pitted, without the pits and the separating septal ridges showing a linear arrangement for any great length as in the first specimen. On the other side the gastral apertures are disposed in more or less distinct lines which run roughly longitudinally and in part radially towards the margin. It would be unnecessary to further describe the specimen, as it agrees with the last in all essential points of macroscopic features.

The third specimen (textfig. 28) is a small fragment, but an important one, since it represents the sponge base which is absent in the other specimens. It consists of a solid cup-like basal mass with concave attachment surface and of a basal portion of the body. The latter represents a flat plate arising from the former slightly inclined towards the dermal side. The dermal side shows deep pits of various sizes, separated from one another by comparatively narrow, reticulating tracts of the skeleton; the gastral surface is perforated by smaller apertures, many of which are seen to communicate directly with the pits of the other side. The condition of the specimen leads one to the belief that the sponge in the original complete state was certainly not of the shape of an entire bowl but represented only a segment of the wall of same, the missing segment probably having been suppressed in its growth at an early period of the postembryonal development. Apparently we have here to do with a case of body shape development more or less similar to that which is known in *Hexactinella grimaldii* Tops., and the fossil *H. laevis* var. *auricularis* Schramm., as well as from *Auloplax filholi* (Tops.) (= *Hexactinella filholi* Tops., 1904), *Bathyxiphus subtilis* F. E. Sch. and *Euryplegma auriculare* F. E. Sch. As regards the first and second specimens before described of this species, I think it reasonable to assume that their missing basal parts were of much the same form as the above third specimen.



Textfig. 28. — *Hexactinella*? *lingua* n. sp. The fragment from Stat. 251, representing basal part of stock. Dermal (*a*) and gastral (*b*) views in nat. size.

Finally, there is from Stat. 262, in the neighbourhood of Great Kei Island, a small dead fragment, the characterization of which is such that I entertain no doubt of its being specifically identical with *Hexactinella*? *lingua*.

Spiculation. — As already mentioned, the superficial dictyonal reticulum of the dermal and gastral sides of the skeleton is generally irregularly meshed, the meshes being of various sizes up to about 220 μ across. The beams there reach 70 μ in thickness. Those most externally situated are tuberculated, especially thickly on their external and lateral surfaces (Pl. XVIII, fig. 13). The tubercles are moderately coarse and of a conical shape. The thickly tubercled spikes on both the surfaces are remarkably strongly developed, though on the whole somewhat less so on the gastral than on the dermal side. They are rounded-conical or finger-shaped, sometimes nearly club-shaped, commonly measuring 165—275 μ long and up to 90 μ thick in

the thickest parts. — In the more deeply lying main mass of the skeleton, the dictyonal tissue is tessellate, consisting, as it does, of intersecting fibers, of course with frequent irregularities in the arrangement of these as well as of individual beams. The subrectangular meshes are on an average 230 μ by 175 μ. The beams in these parts are 30—50 μ thick and mostly smooth or nearly so, being sometimes provided with a small number of scattered tubercles. The nodes are scarcely or but little swollen. The spikes on the lateral surface (pl. XVIII, fig. 15) of septal walls are small and weakly finger-shaped; they are tubercled, the tubercles being frequently developed into spines at the spike end. On the surface just referred to, there is a frequent occurrence of very variously sized, irregular looking hexactins, either simply or a few joined together and ankylosed to the spike and often also to the dictyonal beam at the same time. There seems to be no rule whatever as to the manner of their orientation in relation to one another or to the skeletal parts they are joined to. The hexactins are characterized by being irregularly tubercled, and spiny too at the end of rays. The spiny development is frequently very prominent. About as frequently it happens that the hexactin has assumed the appearance of an almost shapeless spiny mass, owing apparently to an irregular secondary accretion of siliceous matter. The snowflake-like tissue, before mentioned as being attached to the external septal surface or projecting thence in the form of processes laterally into the adjoining canal apertures, consists of numerous similar, irregularly spinulated hexactins connected together in a promiscuous way (pl. XVIII, fig. 14).

Of the loose spicules I could derive only an incomplete knowledge from the specimens. The dermalia and gastralia seem to have been completely lost. On the other hand, scopules and rhaphidial uncinates were met with in abundance. From the manner of occurrence of both, they may safely be regarded as spicules belonging to the species.

The scopule (pl. XVIII, figs. 13, 17) was mostly found scattered about in the dictyonal tissue, but some in association with the rhaphidial uncinate, disposed radially near the dermal surface and with the pronged end directed outwards, which represents without doubt the natural position of the spicule. Length 385—650 μ, of which 40—70 μ appertain to end-prongs. The prongs number commonly 5—7, sometimes 4, to each scopule; they are moderately divergent. Each prong is nearly straight, very finely rough or nearly smooth, and only slightly narrowing towards the end which shows just an indication of a terminal cap.

Uncinates of moderately large dimensions and of the usual development were occasionally met with in fragments, while those of rhaphidial dimensions occurred in great profusion. The latter are exceedingly fine and straight needles, generally 290—510 μ long, rarely as short as about 100 μ, nearly equally or perceptibly unequally attenuated towards both finely pointed ends and traversed right through by the axial canal or thread which normally shows no central cross, nor a simple swelling representing the spicular center, at any point of its length. The surface appears in most cases quite or nearly smooth; sometimes it is slightly roughened by the presence of some obsolete tubercles, and at other times of minute incisions which, as viewed from lateral margins of the spicule, appear like the bracket-steps of a flagstaff. These rhaphidial uncinates are found near both dermal and gastral surfaces, but in especial abundance near the former, where they frequently occur in close parallel groups by the side of the spikes (Pl. XVIII, fig. 13).

The hexaster was found in quite a limited number in certain preparations, attached to what seemed to be a detritus of the soft tissue. In view of the fact that this occurred in a deep part of the dictyonal framework and that the specimens retained rhaphidial uncinates and scopules indubitably their own, I believe the hexasters found were those proper to them. The hexaster was met with in two forms which seem to correspond to the two tylohexaster varieties found in *H. ventilabrum*. The small one, shown in pl. XVIII, fig. 16, measured only about 40 μ in diameter, each moderately short principal carrying a widely diverging umbel of about half a dozen or less terminals with minute terminal swellings. The other is larger, measuring nearly 70 μ in diameter. It was of much the same general appearance as the tylohexaster I have figured from *Periphragella parva* in pl. XIV, fig. 8, and is manifestly identical with the long-principalled discohexaster or tylohexaster of *H. ventilabrum* (Chall. Rep. pl. XCVI, figs. 4, 5). The principals are elongate; the terminal umbel is distinctly shorter, of a bell-like shape, and consists of about 10, exceedingly fine terminals, ending each with a minute tyle. In some of the hexasters the tyles were quite obsolete, so that the terminals appeared to end simply rounded.

5. *Hexactinella*? *spongiosa* n. sp. (Plate XIX, figs. 5—7).

Stat. 251. 5° 28′.4 S., 132° 0′.2 E. 204 m. 13 specimens.

Diagnosis. — Thick-walled, vase-like, reaching 50 mm. in height, with deep pit-like gastral cavity. Skeletal framework made up of branching and anastomosing, in part irregularly columnar and in part plate-like, trabeculæ, between which are widely intercommunicating spaces of 1.5—3 mm. width. These are open both externally and gastrally, and together with the trabeculæ give to the wall a large-meshed spongy appearance. Incurrent and excurrent spaces not distinguishable. The trabeculæ consist of dictyonal latticework with meshes, partly subquadrate and partly irregular in shape; the beams 70—165 μ thick, with conical tubercles on surface disposed in close transverse rows. Loose spicules not known.

Description. — Thirteen specimens of this apparently new species were trawled by the Siboga at her Stat. 251, to the south of Kur Island in Banda Sea. Unfortunately all are in the water-washed state, besides being more or less incomplete in the parts of body wall. Provisionally the species is referred to the genus *Hexactinella*.

The largest and the best preserved of the specimens is shown in pl. XIX, figs. 5 and 6. It is of an irregularly vase-like shape, distinctly laterally compressed and narrowed towards one end which bears a trace of the basal attachment. Height 50 mm.; greatest breadth at the subtruncate oscular end. The osculum (fig. 5) is circular, measuring 12 mm. in diameter. It leads into a pit-like gastral cavity which is about 45 mm. deep and gradually narrows towards the bottom. The wall is very thick. Its thickness in the upper parts of the sponge may be given to be 8—15 mm., being thickest in the broader mesial plane of the laterally compressed body. The entire rigid wall presents an irregularly and thoroughly honey-combed or cancellated appearance. This is due, as can easily be demonstrated by external observation, to the wall being pervaded by a system (diarhysial) of 1.5—3 mm. wide canals or cavities which freely intercommunicate among themselves as well as open both externally and gastrally. Consequently, the skeletal framework is in the form of branching and anastomosing trabeculæ, which are at

places thin and at other places thicker and either irregularly columnar or flattened into small plates of no definite configuration. The columns and plates, on reaching the external limit of the skeletal wall, terminate with truncate or subtruncate, frequently somewhat expanded, free tips or edges. A superficial dictyonal layer, covering the external surface of the skeleton, does not exist though it must have existed originally. Hence one sees on that surface an irregularly reticulate structure with widely open meshes and of essentially the same appearance as that which will be seen on sectional surfaces passing through the skeletal wall in any direction.

On the other hand, the gastral surface is moderately evenly covered with a thin dictyonal layer, which is however perforated by roundish apertures about as wide as the cavities in the wall and separated from one another by spaces nearly as wide as, or somewhat narrower than, the apertural diameter. It scarcely needs to be mentioned that the apertures are those which lead the water from the intercommunicating parietal cavities out into the gastral cavity.

In most parts of skeletal trabeculæ and of the gastral covering layer, a checker-like arrangement of component dictyonal beams is fairly apparent, the more or less quadratic but round cornered little meshes measuring up to about 0.5 mm. in the length of sides. In the trabeculæ, the beams of one set are seen to form long strands which run from below and within obliquely upwards and outwards, of course with variations in relation to irregularities of the trabeculæ. At places, and by no means infrequently, the checker-like arrangement of beams gives place to an entirely irregular-meshed one. This seems to be of usual occurrence in the peripheral parts of the wall. The beams may be unusually strong, generally measuring 70—165 μ thick. They are beset with conical tubercles arranged transversely in interrupted rows (pl. XIX, fig. 7). On the exposed external tip or edge of the trabeculæ there occur robust spikes of an elongate conical shape, rounded at end and of varying length up to half a millimeter, with transverse tubercle rows more closely situated than on the beams. On lateral surfaces of the trabeculæ as well as on the gastral surface, much smaller, finger-shaped spikes occur commonly. The beams and spikes with the tubercles in transverse rows very closely resemble the same of *Tretodictyum schrammeni* n. sp. (pl. XX, fig. 1).

It is a notable fact that, in outward appearance and gross structure of the entire skeleton, the species bears a more or less close resemblance to some other Dictyonina of distant relationship, so much so, indeed, that it may scarcely be possible to definitely distinguish it from these, unless recourse be taken to the examination of microscopic characters. Thus, certain *Myliusia* species, as e. g. *M. callocyathus* Gray (Pl. XXIV, figs. 13—15) and *Scleroplegma conicum* O. Schm. (which species I regard to be a *Myliusia*) as figured by O. Schmidt [1]) and F. E. Schulze [2]), are sponges of a similar general appearance to the present species. *Aulocystis maasi* n. sp. (pl. XXVI, figs. 17—19) is still another case of outward resemblance to the same.

Markedly different as may seem at first sight the macroscopic skeletal structure in this species and in others of the same genus, in reality it is, I think, fundamentally the same. The condition of the skeleton of the former may readily be derived from that of, say, *H. ventilabrum* or *H. vermiculosa*, by assuming that the septal gaps and interseptal spaces of the latter have widened, rendering the choanosomal septa scarcely recognizable as such, but as irregular

1) O. Schmidt, 1880, Taf. VIII, fig. 4.
2) F. E. Schulze, 1887, pl. CI, fig. 1.

branching and anastomosing trabeculæ. A structure similar to this actually obtains in the old basal parts of *H. ventilabrum*.

Genus **Sclerothamnopsis** H. V. Wilson, 1904.

This genus has stood hitherto with the single species, *S. compressa* H. V. Wils. In the Siboga collection I have discovered a form which may be regarded as a second species of the genus. It will be described under the name of *S. schulzei*.

The genus, as consisting of the two species, may be briefly characterized as follows:

Stock of a branching, coral-like habitus; either continuously tubular or in part solid and in part traversed by discontinuous canal-like or slit-like passages. Oscular openings situated either at end or on surface of branches, and all or mostly in the plane of these. Skeletal septa thin, radially and longitudinally running; interjacent diarhyses narrow; both may be scarcely distinguishable, probably owing to abundant development of interseptal connective beams. Dermalia are hexactine pinules with greatly swollen, scaly-spinous distal ray and prolonged proximal ray. Scopule with end-prongs not swollen at end. Oxyhexaster with prolonged principals common. Uncinate with obsolete spines; the smaller ones nearly smooth.

The genus was placed by H. V. Wilson, together with Hexactinella, under the Tretodictyidae, probably on the ground of its close resemblance in habitus to *Sclerothamnus* Marsh. which was included by F. E. Schulze (1886, 1887) under that family. I quite agree with Wilson in that procedure, though as the ground thereof I should rather adduce the fact that both *Sclerothamnopsis* and *Sclerothamnus* are inseparable from *Tretodictyum* as members of one and the same family. *Sclerothamnopsis* seems to be especially closely related to *Tretodictyum*, especially *T. pumicosum*, in that the two agree with each other not only in habitus and skeletal structure, but also in having oxyhexasters of the same type.

Sclerothamnopsis compressa H. V. Wils. (1904, pp. 84—87; pl. 9, figs. 2, 4, 6—8, 10, 11; pl. 10, figs. 1, 3). This species was described from fragmentary and macerated specimens taken by the Albatross near the Galapagos, 551 fms. The type consists of a main axis (20 mm. by 10 mm., transv. diam.) and lateral branches, all lying in a plane and both flattened in the plane vertical to that of the branches, so as to show their edges on the faces of the spreading stock. Skeleton porous but hard and stony, traversed in obliquely longitudinal direction by canaliform (3—6 mm. wide) or slit-like passages which are discontinuous and open externally at ends on the flattened faces of axis and branches. These passages and their external orifices are, in my view, to be regarded as gastral cavities and oscula respectively. The former probably arose, in connection with the latter, as widenings in the general diarhysial canal system, which, for the rest, appears to have narrowed contrarily and so has become obscured, owing to secondary increase of dictyonal beams. To the same cause is apparently due the fact that the dictyonal framework was found to be a close reticulum which is not divisible into lamellae or septa, — a condition which usually sets in at an old stage of life or is always to be seen in the basal parts of *Tretodictyid* stocks. Dictyonal beams and spikes smooth. Dermalia with almost ovoid pinular ray (130 μ long, up to 56 μ thick) with small scaly spines. Scopule with smooth end-prongs, scarcely swollen at end. Oxyhexaster with prolonged principals (about 12 μ) and longer terminals (about 24 μ).

1. *Sclerothamnopsis schulzei* n. sp. (Plate XXII, figs. 5—12).

Stat. 226. 5° 26'.7 S., 127° 36'.5 E. 1595 m. Several fragments.

Diagnosis. — *Sclerothamnopsis* of a dichotomously branching habitus, in places anastomosing; the branches not quite so thick as a pencil, flattened in most parts in the plane of branching, between forking points sometimes nearly cylindrical; tubular, thick-walled, axially traversed all through by a continuous narrow gastral lumen, which opens externally by oscula, situated at end of branches as well as on sides of same. Skeletal wall consisting of longitudinally running, thin and densely fibrous radial septa which are joined together by numerous interseptal connective beams. Dictyonal framework irregularly meshed, made up of beams with scattered microtubercles on surface; spikes densely tubercled, those on the gastral side often greatly prolonged. Dermalia with pinular ray thickly club-like, conical at apex, 137—176 μ long; paratangentials 165—210 μ long, swollen toward end; proximal ray much longer. Oxyhexaster with principals 27—34 μ long; terminals usually shorter, but may be nearly as long. A second, much rarer kind of hexaster may occur in the form of a tylohexaster in which each long principal bears a relatively very short and narrow umbel of 6 or more slender terminals, obsoletely knobbed at end.

Description. — At the Siboga Stat. 226, between Schildpad and Lucipara Islands in Banda Sea, were obtained a number of branched coral-like fragments which proved to represent apparently a new species of H. V. Wilson's *Sclerothamnopsis*. I take pleasure in naming it once again for Professor F. E. Schulze, who has done so much for the cause of promoting our knowledge of the Hexactinellida.

Several of the fragments, including the largest, are reproduced in pl. XXII, fig. 5. They are not improbably all from one and the same stock of which the basal parts are not represented. Of what shape this was, cannot be exactly told; however, it may well be assumed that it was of a branching habitus, somewhat like that of *Tretodictyum schrammeni* or of *Sclerothamnus clausi*. The branching takes place as a rule, though not invariably, dichotomously; all the branches being spread out approximately in the same plane. In a single case (given in fig. 5) there are seen three branches arising from one forking point. Occasionally the branches form anastomosis. It may sometimes measure fully 30 mm. between two successive forks, but more generally the branching takes place at much shorter, though indefinite, intervals. Not infrequently one of the two branches produced greatly lags behind in growth and may thus show itself as a short and small lateral branch of the other. The branches may be in some parts nearly as thick as a pencil, but are more generally considerably thinner. They are either nearly cylindrical or more or less distinctly flattened, the compression occurring in the same sence as the plane in which they spread out, not in the plane vertical to that of the branches as in *S. compressa*. The flattening is always most manifest at the broadened dividing end of branch segments, the thickness at this point being generally 4—6 mm., as measured vertically to the plane of division. Thence above and below, the flattened state of segments grows less marked; and midway between any two forks, the same state sometimes persists to an appreciably degree or the segment becomes nearly cylindrical, the latter being especially the case when the segment is relatively long. The thickness of some branch segments at their middle measured: 6.5 × 6 mm.,

6.5 × 4.75 mm., 6 × 6 mm., 5.5 × 5 mm., 5 × 4.5 mm., 5 × 3.5 mm., 3 × 3 mm. Two small terminal branches measured respectively 4 × 2.5 mm. and 3 × 2.5 mm. across at the free end.

It required but little labour to ascertain that the specimens are in all their parts tubes showing a narrow axial lumen. It seems certain that the entire stock of the species is traversed by a continuous system of lumen. This, which may be called the gastral lumen, is for the most part only about 1 mm. wide, and that even in the thickest parts of the specimens. It is however more or less widened in the parts immediately within oscular openings. Hence, the tube wall in all the older parts of the sponge is relatively very thick. The oscula are roundish openings, 1—2 mm. in diameter. As a general rule, all the free branches, both terminal and lateral, bear each an osculum at the extremity. Exceptions to this occur, for I have found a case or two of the smaller terminal branches being closed at the end. Besides terminal oscula, there also occur, though quite occasionally, some lateral oscula as simple openings on the tube wall; sometimes these may have the margin raised up as if in representation of developing lateral branches. The simple parietal oscula, here implied, are found as a rule in the plane of the branches, as indeed they should be, since they mark the position where a lateral branch might have arisen or may yet arise. However, the rule is not without occasional exceptions in which they are otherwise situated. Perforating clefts passing right through the thickness of the tubes, such as were observed by H. V. Wilson in *Sclerothamnus compressa*, do not exist.

The skeleton is rigidly firm but light and by no means so dense and hard as to be called dense-stony, as *S. compressa* is said to be. On the surface the skeleton exhibits, not very plainly but unmistakeably, its composition out of thin, longitudinally running, radial septa. The septa appear as almost compact and fibrous streaks, owing to their being very close meshed and to their beams, in part forming long continuous strands which run side by side in the longitudinal direction. The streaks, i. e., the external septal edges, may be nearly 0.5 mm. wide, but are more usually much less wide. Here and there in their course, the streaks are seen to divide at small angles, or any two of them may unite into a single streak. On close examination they are generally seen to project externally as slight ridge lines, separated from one another by narrow groove-like depressions, which may be said to be on the whole about as wide as the septa. The septa are connected together laterally, across the intervening groove-like spaces, by numerous, singly running and on the whole transversely directed connective beams at rather close intervals. These beams cut up the interseptal diarhysial clefts into a series of small spaces which may appear nearly like ordinary meshes of the dictyonal tissue, though in fact they are relatively much larger than the dictyonal meshes in the septa themselves. The circumstance may lead one to think at first sight that the entire wall consists of a continuous dictyonal tissue in which longitudinally running beams strands are simply concentrated into bundle-like groups. It is indeed quite possible that that indicates an initial step in the process by which the septal skeleton and interjacent diarhysial spaces have developed, phylogenetically as well as ontogenetically. Actually the parts mentioned of the skeletal wall are, I believe, fully differentiated in most parts of the specimens in question, although the interseptal diarhysial clefts as such appear more or less obscured, simply on account of the presence of numerous connective cross-beams. For *S. compressa* H. V. Wilson, the generic identity of which with the present species seems indubitable, the wall was given by the describer to be dense-stony and not divisible into lamellae.

In spite of that statement I am greatly inclined to assume that probably much the same skeletal structure, as that described above, is proper to that species also, and that the condition ascribed to its skeleton is not unlikely due to the type being an old individual in which the distinction between septa and interseptal spaces has been effaced by excessive secondary accretion of dictyonal elements to the skeleton, as in the oldest (basal) parts of all Tretodictyids.

The gastral side of the tubular wall does not exhibit the septal structure, but appears to be lined by an ill-defined layer of continuous dictyonal tissue in which certain fibers run in the main longitudinally.

Spiculation. — As observed under the microscope, the dictyonal framework is quite an irregular meshed structure, the beams making indefinite angles at points of union (pl. XXII, figs. 6, 7). The meshes, nearly always with rounded ends or corners, are of very various sizes; those in skeletal septa are mostly under $^1/_3$ mm. in width and range down to very small dimensions, while those interseptally situated may reach 0.5 mm. as measured transversely, or in other words, may be as wide as the diarhysial cleft itself at the part. An idea of the dictyonal wall structure may be formed from pl. XXII, fig. 6, in which, without difficulty, may be recognized two septa in cross-section and an interjacent diarhysial space crossed transversely by some interseptal connective beams. The dictyonal beams vary extensively in strength; they are usually under 100 μ thick, sometimes 120 μ or even somewhat thicker. On surface they show minute, irregularly and rather thinly distributed tubercles, which on some beams may be quite sparse and inconspicuous. The nodes may or may not be perceptibly swollen. Rough spikes with pointed or rounded end arise from superficial nodes, not infrequently more than one from a node. Those of the external surface are relatively strong but short, though by no means uniform in development nor in the direction they take after origin. Those on septal and gastral surface are generally slenderly finger-like with more or less pointed end (pl. XXII, fig. 7). Gastral spikes are often prolonged to a needle-like shape, not seldom to such an extent that they take a whip-like or even a fiber-like appearance. Such unusually long spikes generally run longitudinally along the gastral surface, and might be classed with the longitudinal fibers of the gastral dictyonal layer, if only they were connected with that layer, instead of being free at the end.

Free hexactins with slender, obsoletely rough rays, up to about 200 μ long by 4 μ thick, were rarely met with on or near the gastral surface. Probably they are to be regarded as young dictyonal hexactins which are destined to join in the composition of the skeletal framework, though possibly they may in part represent the gastralia. In one of the cases observed one of the six rays was relatively short and somewhat club-like in shape, giving the spicule an appearance of one which might belong to a bounding spicular layer. It may here be mentioned that, aside of the doubtful spicules just referred to, there exist no others that can be definitely called gastralia.

The dermalia are preserved in parts of the specimens protected from abrading influences, though not in the state of forming an intact and continuous layer. As in *S. compressa* they are hexactine pinules with strongly thickened distal and greatly prolonged proximal rays (pl. XXII, figs. 6, 11). The former ray is of a thickly clavate shape with conical apex. It varies much in dimensions; to give some concrete examples of its measurements (length and greatest breadth): 165 × 77 μ, ditto × 55 μ, ditto × 38 μ, 176 × 55 μ, 154 × 38 μ, 143 × 55 μ, 137 × 44 μ. The

apex frequently appears like a small papilla. The surface is of a scaly appearance due to the presence of low but broad and appressed spines, of which large and small ones occur promiscuously. In the lower parts of the ray the spines change into mere tubercle-like swellings of the surface. The paratangential rays measure 165—210 μ in length; they are gently swollen before ending and are beset with microtubercles which are sparse in most parts, but grow more numerous and prominent towards the free end. The prolonged proximal ray is tapering to the end; it may be more than three times longer than the paratangential of the same spicule.

The scopules (pl. XXII, fig. 8) are common, especially so on the gastral side of the wall. They measure 420—660 μ in total length. The end-prongs are 55—66 μ long. They number usually 4 to each spicule, are nearly straight after origin and distally diverge but little. The surface is minutely rough; the tip is rounded but not swollen in the least.

The common hexaster of the species is an oxyhexaster with much prolonged principals (pl. XXII, figs. 9, 10). It is found in all parts of the wall, but most abundantly along the gastral surface, where it may occur close together in numbers. Diameter 77—132 μ. Principals 27—34 μ long. The widely divergent terminals number commonly 2 or 3, more rarely 4, to each principal; they are usually shorter than the principals of the same spicule, and may be only about half as long and seldom nearly as long, as the latter. — A second hexaster form, which is probably to be ascribed to the species, is the long-principalled tylohexaster depicted in Pl. XXII, figs. 12. It was met with in quite a sparse number. In its appearance the tylohexaster is closely similar to that which is found in *Hexactinella* species and in *Psilocalyx wilsoni* n. sp. Diameter 96—112 μ. Principals 38—50 μ long, each with a short and narrow umbel of 6 or more, very slender and about 11 μ long terminals which end each with a minute pinhead-like knob.

Fine uncinates of varying length occur in moderate abundance, without showing a definite rule as to the manner of their occurrence. Very small ones may be only 230 μ long and about 3 μ thick, and are nearly, though not quite, smooth on surface. The larger ones reach up to nearly 1 mm. in length and about 5 μ in thickness. They may be straight or gently bent; the barbation is never well developed, being represented by minute bracket-like dentations which are followed each by a short groove. Under a low magnification, even the larger uncinates may appear nearly smooth.

Remarks. — That the new species, here described, belongs to the same genus as Wilson's *Sclerothamnopsis compressa*, seems to follow indisputably from the agreement of the two species in branching habitus and in the characters of dermalia as well as of oxyhexasters.

Specifically, so far as can be definitely determined, *Scl. schulzei* differs markedly from *Scl. compressa* in being dichotomously branching instead of consisting of a main axis and lateral branches; in the different parts of the stock being flattened, if at all, in the same sense as the plane of the branches, and not in the plane vertical to it; in the dictyonal beams and spikes being microtubercled instead of being smooth, etc. From the descriptions of the two species, it may be thought that there further exists between them a fundamental difference in the structure of skeleton and in the condition of internal canals and cavities: the skeletal septa and interjacent diarhysial spaces, both of which I have described from *Scl. schulzei*, are something quite unknown in *Scl. compressa*. However, in this connection it should be remembered that

the specimen which served as the type of WILSON's *Scl. compressa* appears to represent either an old individual or the basal parts of a stock, while *Scl. schulzei* is based exclusively on fragments apparently still in a relatively young stage of growth. So that, should both the species become better known from more complete specimens, the above structural difference, which under the present circumstances appears to constitute an important point of specific contrast, will probably be found, I am inclined to think, to coincide in a degree with that which obtains in either species between the young (upper) and old (basal) parts of one and the same stock. In fact I believe that, in the basal parts of the stock of *Scl. schulzei*, skeletal septa and diarhyses — and perhaps the gastral lumen too — will be found to be in part or wholly obliterated owing to hypertrophic growth of the dictyonal tissue, somewhat as is known in the type of *Scl. compressa* or as at the base of all Tretodictyids. Conversely, *Scl. compressa* will likely be found to exhibit, in the young parts of its stock, a skeletal structure which approaches in character that of *Scl. schulzei*.

Genus **Sclerothamnus** W. Marsh., 1875.

According to F. E. SCHULZE and KIRKPATRICK (1910, p. 57) this genus is to be placed under the Coscinoporidae, together with *Chonelasma* and *Bathyxiphus*, but I think it is better to place the present genus under the family Tretodictyidae.

The present genus appears to be very closely allied to the preceding genus *Sclerothamnopsis*, but stands distinctly at variance from this in the following characters.

Stock provided with pad-like spiral or annular elevations on surface. Some scopule with transverse processes on shaft; terminal branches frequently strongly divergent and bent backwards. Small floricome-like tylohexaster common.

In the Siboga collection I have discovered a form which may be regarded as identical with *S. clausi* Marsh.

1. *Sclerothamnus clausi* Marsh., 1875. (Plate XXIII, figs. 10—13. Textfigs. 29—32).

? *Farrea densa* Carter 1873, p. 463; Pl. XVII, figs. 5, 6. Ditto, 1876 (appendix to MURIE 1876 [1]).
Sclerothamnus clausi W. Marshall, 1875, p. 171; Taf. XI, Taf. XIII, figs. 10—23. — F. E. Schulze, 1886, p. 83. — Ditto, 1887, pp. 339, 401; Pl. XCVIII. — H. V. Wilson, 1904, p. 87. — F. E. Schulze and R. Kirkpatrick, 1910, p. 56.
Dendrospongia steerei G. Murie, 1876, p. 219; Pls. 36, 37.

Stat. 89. Kaniungan, E. coast of Borneo. 11 m. 5 fragments.
Stat. 156. 0° 29′.2 S., 130° 5′.3 E. 469 m. 3 fragments.
Stat. 159. 0° 59′.1 S., 129° 48′.8 E. 411 m. 1 fragment.
Stat. 260. 5° 36′.5 S., 132° 55′.2 E. 90 m. A dozen or more fragments.
Stat. 262. 5° 53′.8 S., 132° 48′.8 E. 560 m. 2 fragments.
Stat. 305. Solor strait. 113 m. 3 fragments.

Diagnosis. — Stock large, dichotomously branched like a broadly expanding tree. Branches forming the upper parts of stock about as thick as the little finger and exhibiting a

1) Earlier references to the type of CARTER's *Farrea densa* are: OWEN, 1857, Pl. XXI, fig. 8 (not figs. 9, 9*a*)
Farrea occa in part, BOWERBANK, 1862, p. 1118 (not Pl. XXXII, fig. 7). — Ditto, 1864, p. 204; Pl. XV, fig. 277 (no, Pl. XXI, fig. 311). — GRAY, 1867, p. 507 (misprinted "*F. orca*"). — W. THOMSON, 1868, p. 119. — BOWERBANK, 1869, p. 76. — Dittot 1869, p. 76. — Ditto, 1869, p. 339; Pl. XXIV, fig. 1 (not figs. 2—7).

spirally winding pad-like elevation which alternates with a narrower groove-like zone. This characterization quite or nearly disappears in the lower parts of stock, i. e. in main branches and stem, which are flattish. Oscula of moderate size, open orifices occurring in irregular distribution on the free surfaces, which, for the rest, is probably covered all over by a delicate and continuous dermal layer. Subdermally there open numerous inhalent apertures which are of various sizes but on the whole small. These apertures, as also the oscula, lead internally into a system of intercommunicating interseptal or diarhysial canaliform spaces which run in the main longitudinally. In relation therewith, the dictyonal skeleton consists of trabecula-like, anastomosing and in the main longitudinally running septa joined together by numerous framework bridges and singly running connective beams. In old parts of the stock the skeleton presents a densely cancellous structure. Dictyonal beams studded with tubercles, of which the larger are denticulate on top. Nodes not swollen. Dermalia are relatively weak-rayed hexactins with distal ray not pinularly differentiated. Scopule rough in all parts, present in two varieties: the larger with bell-shaped umbel of end-prongs; and the smaller with very strongly divergent, frequently even backwardly curved, end-prongs and with shaft which is provided with short transverse branches. Hexasters in two kinds: a small floricome-like discohexaster, frequently found on tip of distal ray of dermalia; and a much larger spherical discohexaster with extremely short principals and rather strong terminals, ending each with a circle of a few strong recurved claws. Strong uncinates present.

According to CARTER (1876), his *Farrea densa* (1873) from the Seychelles should be synonymous with the present genus and species, but the evidence therefore cannot be considered sufficient, because of the very defective condition of the fragments on which *F. densa* was based. The first detailed description of the species was given by MARSHALL (1875), who named it *Sclerothamnus clausi*, from two specimens in the Leiden Museum, of which the locality is unknown. The same species, under the name of *Dendrospongia steerei*, was very accurately described also by MURIE (1876) from a magnificient specimen which was obtained in the channel between Cebu and Negros, Philippine Islands, from a depth of between 70 and 100 fathoms, and which should now be preserved in the Museum of the University of Michigan, U. S. A. The Challenger obtained, according to F. E. SCHULZE's report, two dead fragments of the species in the neighbourhood of Banda Island (not Timor as given in that report, p. 339, but Chall. Stat. 194[a], 4° 31′ S., 129° 57′ 20″ E.) from a depth of 360 fathoms. Now the Siboga expedition has collected numerous fragmentary specimens, without doubt referable to the species.

Description. — Relatively the best preserved fragments were obtained at the Siboga Station 260, to the west of Great Kei Island. Here the dredge brought up more than a dozen large and small fragments, which have possibly originated from one and the same stock. Most of them have preserved the loose spicules, though not to a fully satisfactory extent. The four specimens shown in textfig. 29 and in pl. XXIII, figs. 10 and 11 (all in natural size) should give a fair idea of the general appearance of the specimens. Most of these are uneven-surfaced, irregularly contoured and somewhat bent rods with indications of dichotomous branching. Some of them, as, e. g. all those which are figured, represent parts of branches, in which one end is either the natural free tip or that broken off at a point presumably not very far distant from it. The specimen of textfig. 29A is the longest of all. The fragments are at places about as

thick as one's finger, though at certain other places and near their distal end the thickness may fall considerably below that. They are scarcely ever quite cylindrical but are more or less flattened in the plane which coincides with that of branching. For instance, the thicknesses measured at three different parts in the piece of textfig. 29 A are: 11 × 10 mm., 15 × 12 mm., 13 × 10; same in that of textfig. 29 B, 9 × 7 mm., 20 × 11 mm., 17 × 11 mm.

The sponge is rigid. Externally it is of a more or less pumicose or cancellous appearance, exhibiting numerous apertures of various sizes, mostly under 1.5 mm. in diameter. Many of the fragments have partially preserved the delicate, lattice-like layer of the external surface, covering over the said apertures. From the manner in which the remnants of the layer extend or are distributed, it seems quite justifiable to assume that, in the original intact state of the specimens, the layer in question extended continuously all over the free external surface of the sponge, probably interrupted only by the presence at certain positions of freely open excurrent orifices (oscula). Let it here be given at once, that I take the entire covering layer for the dermal, at whatever situation of the external surface it may be found. In this I differ from F. E. Schulze (F. E. Sch. and Kirkp., 1910, p. 57), according to whom one side of the sponge is dermal and the other gastral. But of this mention will be made later on.

In spite of the sponge exterior being but little or not at all abraded, none of the fragments, collected at the station, show a distinct trace of the peculiar spiral pad or whorls of pad-like elevations, which constitute a characteristic feature of the species as described and figured by both Marshall and Murie. The pads should occur, in alternation with groove-like depressions of the external surface, most prominently developed on the top of branches, i. e. in the relatively young parts of the stock; while on the lower parts of branches and on the stem they should be quite unobservable or but very weakly indicated. Murie found in the lower parts of the stock several obliquely running, shallow impressions or concavities only, which were seemingly traces of the grooves so well marked between the whorls of pads in the upper parts of all the branches.

Textfig. 29. — *Sclerothamnus clausi* Marsh. Two largest fragments from Stat. 260, in natural size.

A, a macerated piece of branch, in part infested by a soft Monaxonid sponge. Origins of lost branches indicated by broken lines.

a, a perforation going right through the branch.

b, *c*, socket-like or groove-like depressions, which probably arose as widenings of diarhysial canals.

B, another piece of branch with uneven surface, of which the transverse convexities and concavities are possibly vestiges of the spiral pads and grooves.

Two more fragments from the same Station are shown in pl. XXIII, figs. 10 and 11.

In all appearance, then, the pads are something which presents itself in most prominent development while the sponge parts are still relatively young, but which becomes obliterated as these grow older, concomitantly with the growth in girth. If that be so, it is easy to conceive that even such young branches as show the pads most distinctly, may in time change into the condition of the lower parts in the same stock where there exist no or scarcely any pad. Now, the fact that the Siboga specimens under consideration, including those which apparently represent parts of top branches from the upper parts of a stock, are without the pads, but nearly approach in the condition of their external surface, the parts in the basal half of the stock figured by MURIE, I am inclined to explain simply by assuming them to be in an old stage of growth in which the pad-like elevations, originally present as such, had become obliterated. Something like the alternating weak convexities and concavities, which were noticed by MURIE on the surface of the main branches of his specimen and may possibly be remaining trace of the pads and grooves, can be observed also on the fragment reproduced in textfig. 29 B. The unevenness of surface in some other fragments, as, e. g., in the one shown in pl. XXIII, fig. 10, may to some extent be likewise due to the pads and grooves which originally may have existed in the parts. Noteworthy in this relation is the fact that, in the two fragments just referred to, what still remains of the external covering layer, exists in part in continuous strips extending lengthwise over a surface space which may safely be estimated to be much longer than that which would be taken by the combined breadth of a pad and a groove in direct succession, if these were existent there; and that without demarcations or differentiations of any sort in the layer throughout the extent of its continuity. This may be taken for an indication of the fact that the covering layer of both pads and grooves is of one and the same kind, which should then be regarded to be the dermal in exclusion of the gastral.

From studies on sectional surfaces it can without trouble be ascertained that the sponge is internally traversed by a system of anastomosing canals, as has been known from the accounts given by both MARSHALL and MURIE. More exactly speaking, the canals represent narrow interstitial spaces, longitudinally extended, disposed close together side by side and intercommunicating with one another at frequent intervals by means of gaps in the dividing wall. They pervade the entire sponge from stem to tips of branches in one continuous system, without being divided by skeletal partitions into incurrent and excurrent systems. In fact, the entire canal system is diarhysial, opening on the one hand, subdermally by means of ostia, and on the other, freely externally by oscula occurring at certain positions. Here and there in the younger parts of branches there occur short canals distinctly wider than the rest, and which penetrate vertically inwards from the surface of skeleton to communicate internally with longitudinal canals of the general diarhysial system. I am inclined to take those transverse canals for cloacal (or gastral) passages for the outflow of water. In pl. XXIII, fig. 11, which represents the longitudinal section surface of a twig, some such transverse canals are seen in cross-section. Anything like an axial lumen, such as exists in *Sclerothamnopsis schulzei*, is not observable in any part of the branches.

The skeletal septa, which run in the main longitudinally and determine the course and configuration of the diarhysial canals, are by no means always and in all their parts well-defined structures, as they are in, e. g. *Tretodictyum schrammeni*. They seldom, if ever, present

themselves as distinct plate-like walls or columns, but are generally simply indicated by the long dictyonal fibers which run in them longitudinally, arranged in small bundle-like or thin and radially disposed sheet-like groups, much as we have seen in *Sclerothamnopsis schulzei*. The longitudinal fibers, at the end of their upward course, successively incline towards the surface of the skeleton, there to terminate one after another at all heights of the branches (pl. XXIII, fig. 11). The ill-defined state of the septa is apparently due to the frequent and abundant occurrence, similarly as in *Sclerothamnopsis*, of interseptal connectives in the form of either singly running or reticulating cross-beams, whereby the limits of septa are obscured, while the interseptal spaces may at places appear cut up by the connectives into little mesh-like spaces scarcely distinguishable from those of the ordinary dictyonal reticulum. The above condition of the skeleton may perhaps be interpreted to represent, on the contrary, a state in which the differentiation of skeletal septa from a general mass of dictyonal reticulum still stays at a more or less incompletely advanced stage.

Of the numerous, large and small apertures, by which the diarhysial canal system opens on the external surface of the skeleton, the majority are without doubt ostia for the inflow of water. There can be no question about that for all those apertures which are actually found covered over by the remaining dermal layer. Such indubitable ostia are met with in numbers on the branch fragments shown in textfig. 29 B and pl. XXIII, fig. 10, in which they are observed to be more or less angularly shaped openings, reaching 1.5 mm. or somewhat over in diameter. The larger of them occur in irregular distribution, and at places pretty close together in numbers. Of the freely exposed apertures in all the specimens of the lot, some are certainly to be looked upon likewise as ostia which have lost the covering dermal layer by abrasion, while certain others, but especially the larger (about 2 mm. across) of them in scattered distribution, are presumably oscular openings which are a b o r i g i n e without the covering layer, although not admitting of definite discrimination as such from the rest of the open apertures. At least it is extremely improbable that the apertures in question, distributed as they sometimes are on the entire surface of branch pieces more than 80 mm. long, are exclusively ostia and not oscular openings.

Scarcely possible as it is to get a clear idea of oscular openings from any of the specimens obtained at Stat. 260, I should here call attention to certain perforations and depressions found in some of them, which, when taken in comparison with similar perforations and depressions soon to be described from specimens obtained at other stations, will be recognized to have probably arisen in connection with cloacal or gastral widenings of the diarhysial canal system. Firstly, in the long piece of branch represented in textfig. 29 A, there exists near its uppermost bifurcation point a moderately large perforation (*a*, indicated in the figure by an arrow) going right through the branch, and each of the next following two bifurcation points an irregular but distinct, socket-like (*b*) or groove-like (*c*) depression. Secondly, there is in the same lot of specimens another fragment, about as long as one's finger and as thick as a pencil, showing at one part a groove-like depression and at another a perforation similar to that seen in the last specimen. Thirdly, the fragment shown in pl. XXIII, fig. 10 exhibits on one side of its fractured upper end a small socket-like depression (not visible in the figure) which is in all probability the same in nature as that existing in the first specimen.

From Stat. 262, west of Great Kei Island, there are two small fragments, probably

representing terminal parts of top branches. Both are in a completely washed-out state and without noteworthy points in their appearance and structure.

Stat. 305, in the Solor Strait at the eastern end of Flores, has yielded three specimens, all likewise completely macerated fragments. The two largest of them are illustrated in textfig. 30 and in pl. XXIII, fig. 12. With regard to the one shown here in the text, which is shaped exquisitely like the end of an antler and includes two bifurcation points, the following remarks may be made. At the upper bifurcation point there exist a moderately large perforation; this is situated on one side flush with the surface of the branch, while on the other it opens into the upper end of a well marked and deep but short groove, as can be seen in the figure. A second, very much smaller perforation, is noticeable at the lower bifurcation point; its position is indicated in the figure by an arrow. In some parts of the surface, as, e. g., on the smaller upper twig, the composition of the skeleton of longitudinal septa is observable with moderate distinctness. The large specimen reproduced $^{3}/_{4}$ natural size in pl. XXIII, fig. 12, evidently represents the basal parts of a stock and closely resembles in its general appearance the same parts of the splendid specimen figured by Murie. It seems to have been attached to the substratum by one side of the expanded basal end. It is in most parts distinctly flattened in the plane of the several branches, the stem measuring 26 × 20 mm. thick a short distance above the basal expansion, and the branches 22 × 16 mm.; 16 × 11 mm., etc. in thickness. Large and small canal apertures occur in much the same way on both broad sides of the stem and branches. Specially noteworthy are the following apertures which are considerably larger than any of the rest and seem to be confined in their occurrence to dividing places of the stem. On each of the two upper places of division, as will be seen in the figure (pl. XXIII, fig. 12), there exist on one side two such apertures, one of which leads into a passage, opening on the other side and is in fact an entrance into a perforating canal. On the third and lowest dividing place there also exist similar openings or depressions in some number. One of these is a large and deep dimple-like depression (visible in the figure); another is a small opening through which the light from the opposite side can be seen and which thus probably represents an early stage in the formation of a large perforation which would be open later. The third specimen from the same station is a short piece as thick as one's finger, again with a fenestra-like perforation passing right through it.

Textfig. 30. — *Sclerothamnus clausi* Marsh.
A macerated fragment from Stat. 305, in natural size. Another large fragment from the same station is shown in pl. XXIII, fig. 12. The arrow indicates the position of a small perforation passing through the branch.

At Station 89 (shore exploration, Kaniungan Island, E. coast of Borneo) were collected some old dead fragments of the species, representing parts of branches and a stem with basal processes for attachment. The latter (textfig. 31 A) is subcylindrical, measuring 28 mm. in thickness in the middle. Its upper worn off end is notable in that it shows a wide and moderately deep axial hollow which gives to that end of the stem the form of a thick-walled tube or cup, in contrast to the more inferior parts which may be called solid, in spite of the diarhysial canal system which pervades all parts of the skeleton. The wall of the cup-like part is fenestrated by large roundish or irregular shaped perforations, about half a dozen in number. One of them (situated on the side not visible in textfig. 29 A) leads out externally into a pronounced but irregular groove-like depression, running longitudinally on the surface of the skeleton. The hollow I regard to be a space (cloacal or gastral) identical in its origin and nature with the depressions and fenestra-like perforations seen in many other specimens of the species obtained by the Siboga. Only, as it seems to me, the concave space is here excessively spaciously developed and communicates with the exterior by means of several instead of only one or two, openings. The openings I regard to be oscula. I shall try to make this point clearer further on. Similar external openings of a relatively large size exist in irregularly scattered distribution further down on the stem, amongst numerous others which are smaller. Both are alike external apertures of the diarhysial canal system, the former being in my opinion probably oscula and the latter, ostia. However, since the two kinds of apertures apparently merge into each other as regards their size, a definite discrimination between them is not always possible in the state of the specimen completely denuded of the covering dermal layer. Were this preserved, the oscula would probably be found to open freely, and not covered over by it, as all ostia should be. The skeleton as seen from the outside may be said to be on the whole of a more or less cancellous structure, but exhibiting in addition its constitution out of dividing and anastomosing longitudinal septa, more distinctly at some places than at others. The septa are plainly recognizable on the wall of the wide concavity at the superior end of the specimen.

Textfig. 31. — *Sclerothamnus clausi* Marsh.
Two macerated fragments from Stat. 89, in natural size.
A, a stem with basal attachment processes below and a wide fenestrated concavity above.
B, a branch fragment including two bifurcation points, each showing a large fenestra-like perforation.

Of other specimens which are parts of branches in most parts distinctly flattened, from

the same Station (Stat. 89), the following three demand brief notice. In the first place, the piece given in textfig. 29 B, is distinguished by being perforated right through by moderately wide tunnel-like passages at two places, both bifurcation points of the branch, in agreement with the cases previously noticed of similar perforations. Moreover, the piece exhibits the septal structure with moderate distinctness. There exists in the same lot of specimens still another piece showing a similar perforation situated close to the severed end, which presumably stood originally in direct junction with the fellow branch of the piece. Finally, there is in the same lot a piece of a forked twig; this shows at the usual situation, not a perforation, but a short longitudinal groove-like depression, present on one side only of the piece. This is of interest in as much as it appears to represent an early stage in the formation of the fenestra-like or tunnel-like perforations through the branches.

Here may be mentioned the fact that all the specimens from the four stations hitherto taken in consideration, viz., Stations 260, 262, 305 and 89, exhibited on dictyonal beams of their skeleton numerous tubercles which in part are characteristically denticulated on top, a feature of much importance in the specific identification of the specimens.

From Station 156 in the Halmaheira Sea, there are three dead and completely washed-out fragments, which, while essentially agreeing in structural respects with other specimens of the species obtained by the Siboga, differ from them in this that the dictyonal beams seem to be unusually sparsely tubercled, none of the tubercles present being denticulated on top, but all of a simply conical shape. One of the fragments from the same station is of a finger-like shape, apparently representing the terminal parts of a branch, as figured in pl. XXIII, fig. 13. It shows with distinctness the skeletal structure as being made up of dividing and anastomosing longitudinal septa, which are in part columnar and in part plate-like and are in places connected together by transverse beams running across interseptal diarhysial spaces. These open externally by interseptal gaps which are in part small and roundish and in part much wider and more or less elongate in the longitudinal direction. Another noteworthy fragment (textfig. 32) from the same station is an old piece 35 mm. in transverse breadth, apparently representing probably a portion of the stem. It shows on the external surface a number of relatively large and mostly longitudinally elongate orifices, distributed at varying but rather wide intervals among a crowd of others which are on the whole very much smaller. The former, which may reach 8 mm. or more in length and 2.5 mm. in breadth, probably represent oscular openings and the latter the ostia; but a strict discrimination between the two cannot be carried out, since there exist orifices of intermediate dimensions and no covering dermal layer remains to distinguish the ostia. Finally, there is from Station 159, also in the Halmaheira Sea, a very small and much corroded fragment, which may be regarded to be probably of the same form as the last mentioned specimens.

Textfig. 32. — *Sclerothamnus clausi* Marsh.
A macerated fragment from Stat. 156, probably representing a portion of the stem.

Now let some remarks be made on certain points in the morphology of the species. As

will have been seen from the foregoing descriptions, I regard the entire inner parts of the sponge, the choanosome, to be pervaded by a continuous system of diarhysis. This canal system should receive the water through the entire external (dermal) sponge surface, and discharge the same by certain orifices (oscula) opening scatteredly on that surface.

As regards orifices in general on the external surface, MARSHALL has meagrely mentioned the occurrence of very variously sized ones, certain of which appeared to have been surrounded by a low cuff-like wall. No distinction was made by him as to their being oscular or not. In the photographic illustration of the stock described by him there are clearly visible a number of prominently sized apertures which I should unhesitatingly regard to be oscula. These large apertures are found irregularly scattered in the lower and older parts of the stock, and on the branches too on which they are, in part at least, distinctly situated in the interspaces between spiral pads. MURIE, in his detailed description of another specimen of the species in an excellent state of preservation, has given as oscula certain relatively large apertures found widely scattered all over the free surfaces amongst a crowd of smaller but moderate-sized "pores", by which term was evidently meant the ostia. The apertures taken by him for oscula — and that quite rightly, I think — are undoubtedly the same as those which I have noted above as being plainly visible in MARSHALL's figure and which I regard to be really oscula. The delicate dermal lacework, discovered by MURIE over the major portion of his specimen, was assumed by him to clothe possibly the entire sponge in the original intact state. In this I agree, but with the reservation that oscula were probably freely open. The distribution of the remnants of the covering lacework, as observed by me on certain specimens from the Siboga Station 260, seems to fully support that view, and also to justify calling the entire extent of it by the name of the dermal layer. If that be so, it goes without saying that the entire external surface of the sponge should be regarded as dermal. It then seems only appropriate to call the apertures, which open — probably freely — at isolated positions on that surface and probably serve for the outflow of water from the internal canal system, by the name of oscula, as I have done in agreement with MURIE. In fact, I am greatly inclined to regard *Sclerothamnus clausi*, as regards the morphology of its body parts, to be essentially the same as in *Tretodictyum* or *Sclerothamnopsis*. I should not have dwelt on these points at such length, were it not for the different view held by F. E. SCHULZE (F. E. SCH. and R. KIRKP., 1910, p. 57).

According to him, the body of *Sclerothamnus clausi* should have developed like that of *Bathyxiphus*, in such a way, that its one side represents the dermal and the other the gastral surface; the branches should have undergone a twisting around the long axis, so bringing about the spiral pads and grooves respectively with the gastral and the dermal surface; the apertures found on spiral pads should be aporhyses and must therefore not be called oscula. None of the above points seems to me sufficiently supported by observed facts as to compel acceptance. In the first place, the stem and main branches, flattish though they are in form, show no differentiation whatever between their two broad sides in regard to structure or spiculation. Above all, the relatively large apertures, which are in all probability for the outflow of water, are not confined in their occurrence to one of the sides, but are present about equally on both sides together with others which may be regarded as ostia. Thus, it seems at least quite natural to take the external sponge surface all around the stem and main branches for the dermal.

The same may be said in reference to the alternating pads and grooves of the smaller branches. In those parts, prominently large apertures, which are in all likelihood exhalent, do seem to exist on the surface of the grooves, as one may see from the figure given by MARSHALL of the sponge. The presence of similar apertures, also on the pads, cannot be definitely ascertained from the representations of authors. The appearance is that what canal apertures there may exist on the pads, supported as these are known to be by dictyonal fibers in dense tufty arrangement, they are mostly, if not all, small ones which might sooner be taken for the inhalent than for the exhalent. Anyway, I see here again no distinctive criterion by which to discriminate the pad surface as the gastral and the groove surface as the dermal.

In the second place, the twisting assumed by F. E. SCHULZE (F. E. SCH. and KIRKP., 1910, p. 57) of the branches is a point which seems to be without a good foundation. It is impossible to imagine that the superficial (gastral and dermal) layers alone could have twisted themselves so as to assume the close spiral arrangement of the pads and grooves, independently of the deeper parts and without involving the internal canals and septa in the twisting. As a matter of fact, apart from the spiral arrangement shown by the superficial pads and grooves, no indication whatever of a twisting has ever been noticed in connection with the internal structure. MURIE's illustration (his Taf. 36, fig. 4) of the mode of skeletal arrangement in the terminal twig, as also all the pieces of branch skeletons in the "Siboga" collection (pl. XXIII, figs. 10—13), exhibits the longitudinal dictyonal fibers of septa, gently curving outwards in their course and coming up to the surface at all points with their superior end, but never uniformly laterally bent either way, as they should be in their terminal parts at least, if the branches had undergone torsion one way or the other around their axis. That being so, the choanosomal skeletal bundles or septa, together with interjacent canal spaces, run all in the main longitudinally, pursuing their course continuously throughout the length of a branch; so that, the same most peripherally situated bundles or septa directly underlie in their course both the pads and grooves of the external surface in alternate succession. This is a state of things which is utterly incompatible with the conception that the pads and grooves represent two originally opposite (gastral and dermal) surfaces of an elongate and flattish body. The spiral pads, in my opinion, did not arise as the result of the twisting of the branches, any more than the spiral ledges of *Euplectella* arose from the twisting of its body.

Now a few words about the peculiar perforations that we have seen piercing right through the thickness of branches in a number of the macerated fragments collected by the "Siboga", as e.g., in those shown in pl. XXIII, fig. 12 (Stat. 305) and in textfig. 29 A (Stat. 260), textfig. 30 (Stat. 305) and textfig. 31 B (Stat. 89). The perforations, often of a conspicuous and fenestra-like or tunnel-like appearance, occur invariably in connection with the forking point of branches, i. e. near the upper end of branch segments, singly at a time. Judging from the various conditions in which they are met with, they seem to represent at first a narrow passage indistinguishable from, and evidently in direct communication with, ordinary diarhysial spaces in the skeleton. In course of time the passage, together with the external openings at both its ends appears to widen, so converting it into a conspicuous perforation, such as was spoken of above. It may perhaps be reasonably presumed that this widening is effected either by resorption or by mechanical breaking up of the dictyonal skeleton in the parts directly adjoining the passage.

The openings, in all stages of their existence, I am greatly inclined to regard as oscula, i. e., as orifices which serve specially for the outflow of water from the diarhysial canal-system. Indication is not wanting that the orifices — or the entire perforating passage — undergo prominent enlargement only after the sponge or the sponge parts standing in direct relation with them, have attained a certain stage of growth. None of the previous writers on the species observed the perforation under question; this may possibly be due to the specimens examined by them having been at a comparatively early stage of life in which the perforation has not yet made distinct appearance. Whereas the "Siboga" specimens represent apparently older stocks in which the spiral tufty elevations have quite or nearly quite disappeared even on the terminal twigs, as in the oldest (basal) parts of the stocks described by previous authors.

In association with the above perforation there was sometimes observed the presence of a short groove-like depression on the skeleton surface and on either side of a branch. One such case is plainly observable in textfig. 29 (Stat. 305). The depression may be regarded as a space formed by the joining together of a number of diarhysial canals; it may also well be interpreted as a cloacal or gastral space which might have arisen by extension of the same process as that which caused the widening of the perforating passage. To the same category evidently belong the irregular socket-like depressions which we have seen in the fragment (Stat. 260) of textfig. 29 A (*b*, *c*). Further, the large fenestrated hollow at the upper end of the stem fragment (Stat. 89), shown in textfig. 31 A, may probably be classed with the depression here under consideration.

Spiculation. — The composition and arrangement of the dictyonal skeleton are, especially through Murie's description and figures, so accurately known that I can add no new facts of much importance from my own observations on the "Siboga" material. Dictyonal meshes generally not regularly square. Beams of variable thickness up to 120 μ. Freely ending spikes as also newly arisen beams may be only 20 μ thick. Quite occasionally a beam may be as thick as 200 μ, as the result of fusion of originally separate beams. The peculiar denticulated tubercles (Chall. Rep., pl. XCVIII, fig. 11) most numerous and best developed on spikes and on beams of less than average thickness. Simply conical tubercles abound on the stronger beams, either in association with the denticulated ones in varying numerical proportion or by themselves alone, in which latter case they are usually weakly developed and occur in rather scattered distribution.

Those beams which form the longitudinal strands run, as has been known from Murie, from below upwards, finally curving outwards before terminating on lateral sponge surface. This is a condition quite similar to that which obtains with the corresponding spicular strands in *Tretodictyum schrammeni*.

The loose spicules I have been able to study only from the specimens obtained at Stat. 260.

The dermalia are relatively small and weak hexactins. They have rays generally 6—10 μ (sometimes 13.5 μ) thick at base, obtusely or conically pointed at end, straight, and minutely spinose, the spinules being erect and especially numerous towards the end. Tangential rays 165—220 μ long. Distal ray shorter, in most cases only 55—80 μ long; sometimes rounded at tip unlike the other rays. Proximal ray generally shorter than the tangential but longer than the distal or about as long as the latter; this seems to be always the case with those dermalia

which form parts of the layer extending freely over canal apertures. In certain other parts the proximal ray may be prolonged so as to nearly equal or even exceed in length the tangential of the same spicule. Occasionally all the six rays may be of approximately same length. The quadrate meshes of the dermal layer measure 175—240 μ in length of sides.

As regards the scopules my observations are again in nearly complete accord with MURIE's. They may be distinguished into two varieties, although these pass by gradations imperceptibly into each other. Variety *a* of the scopules is the larger, measuring commonly 300—550 μ in length (Chall. Rep., pl. XCVIII, fig. 9). Terminal umbel of prongs 45—70 μ long, cup-like or deeply bell-like in shape, or distally somewhat expanding; the prongs usually 4 (rarely 2 or 3) in number, minutely rough all over, very slightly capitate at end, in the circumference of which the microspines are more or less distinctly retroverted. The shaft more sparsely microspined, up to about 8 μ thick close to the head end, without branches. Exceptionally large spicules of the variety reach 770 μ in length, the terminal prongs measuring 100 μ or 120 μ long while their numbers are increased to 5 or 8. Variety *b* is commonly 230—175 μ long; minutely rough all over, the shaft characterized by bearing short and long branches which stand out usually vertically (Chall. Rep. pl. XCVIII, figs. 7 and 8). The umbel of terminal prongs sometimes cup-like in shape, at other times widely funnel-like or nearly flatly expanding, with the prongs straight or distinctly bent outwards or backwards; the prongs 3—5 in number, 23—30 μ long, finger-like, slightly capitate at end. Lateral branches of shaft up to 23 μ in length, also slightly capitate at end, rough like the shaft. Both the varieties occur together in abundance in the peripheral parts of the sponge; in the deep parts only the variety *a* is found, with the umbeliferous end projecting into the canal lumen. As intermediate forms between the two varieties may be mentioned those which, besides being of a medium size, have the umbel much like that of variety *a* and at the same time show on the shaft indications of lateral branches in the form of minute knobs, of which an isolated one or two may be developed into distinct branches.

Strong uncinates of typical appearance are of by no means infrequent occurrence. Length 1.5—2 mm., and 17—38 μ thick in the thickest part which generally lies at about the middle of the thicker half of the spicule. The barbs are far more numerous than are shown in F. E. SCHULZE's figure of the spicule in the Challenger Report.

The rosettes are of two kinds, both discohexasters. By far the more numerous is the small floricome-like kind, measuring only 40—50 μ in diameter. Each slender principal of medium length (about 5 μ long) bears a liliaceous bunch of 7—9 delicate terminals, each ending with an inverted-conical swelling arched on base which is indistinctly toothed at the circumference. The figures given of this discohexaster by both MURIE and F. E. SCHULZE are fairly good; only the rosette, as exemplified by same in the Siboga specimens, has much finer terminals and is of a more delicate appearance as a whole. The terminals to each principal are not always in a whorl, but more usually there exists a central terminal which is surrounded by the rest. Contrary to F. E. SCHULZE's statements in the Challenger Report, the rosettes originally belong to the parenchyma; I have met with them in all parts of the sponge. However, as already known, some of them shift to tip of distal ray of dermalia, exactly like the floricome of *Euplectella*.

The second kind of rosette is a large spherical discohexaster, which is very succesfully represented in MURIE's pl. XXXVII, fig. 25 and which seems not to have been found by

F. E. SCHULZE. As was remarked by the former author the rosette is very rare; I have discovered it only in a very limited number after long searches. Two complete specimens of it were found to measure both 220 μ in diameter (MURIE gave the diameter to be $^1/_{78}$—$^1/_{62}$ inch, i. e. say, 320—400 μ). Principals extremely short and forming a tuberculate-like centre, from which there arise in all directions moderately strong and straight terminals, about 20 in all. Each terminal ending with 3—5 strong, recurved teeth (27 μ from point to point of two opposite teeth).

Genus **Psilocalyx** n. g.

With the following single species.

1. *Psilocalyx wilsoni* n. sp. (Plate XXIII, figs. 1—9).

Stat. 226. 5° 26′.7 S., 127° 36′.5 E. 1595 m. Fragments.
Stat. 267. 5° 54′ S., 132° 56′.7 E. 984 m. 1 specimen and fragments.

Diagnosis. — Subcylindrical cup attached by broadened base, with very thick wall traversed by wide, anastomosing and labyrinthine diarhysial canals, opening externally by wide roundish or irregular-shaped apertures. Without dermal and gastral spicular covering layer. External surface of dictyonal skeleton dense and crust-like, consisting of greatly thickened superficial dictyonal beams and of remarkable knob-like or boss-like swellings found in the place of spikes, both the beams and swellings are uniformly and thickly tubercled on surface. Dictyonal beams in deeper parts thinner, with much fewer tubercles in scattered distribution and at places developed into rather prominent spines. Scopules moderately large, with 5 or 6 slender, nearly straight and minutely barbed end-prongs terminating almost simply rounded. Hexaster in one kind, viz., a tylohexaster with long principals, bearing each a shorter elongate-bell-shaped tuft of 8—10 terminals ending with exceedingly minute or even indistinct knobs. Quite or nearly smooth uncinates of rhaphidial fineness very abundant.

Description. — As type of this new genus and species has served a nearly completely preserved specimen (pl. XXIII, figs. 1, 2) from Stat. 267 in Arafura Sea, east of Great Kei Island. From the thick and irregular attachment base, horizontally 52 mm. long and 15—27 mm. broad, there arises the stumpy subcylindrical body, about 38 mm. high and 32 mm. thick. It may be called a very thick-walled cup. In the middle of the subtruncate superior end opens the osculum of about 10 mm. diameter (pl. XXIII, fig. 2), leading into a deep, pit-like, and inferiorly narrowed gastral cavity. The sponge wall is 10—14 mm. thick in the middle of the body.

All over the rigidly hard sponge, both body and base, there are numerous roundish, oval or irregularly oblong, incurrent canal apertures of varying but comparatively large size, mostly measuring 1.5—3.5 mm. across. The interapertural surface of the sponge thus forms a reticulum of broad bands generally 2—4 mm. wide. It is at places more or less arched externally, at other places moderately flattened. Usually, but not always, it passes at the apertures into the wall of diarhysial canals with an angular bend, not infrequently at an angle of less than 90°, so that the apertures have a more or less sharply defined edge. In the wet state of the specimen the external surface is of a pretty even and compactly granular

appearance; under the hand-lens it looks not unlike a fine grained shagreen, showing here and there some pores among the densely aggregated granules. In the completely desiccated state and under the hand-lens, the surface reveals its dictyonal structure as a somewhat jaggy reticulum of a glass like appearance, with minute roundish pores as the meshes (under 275 μ across).

The entire thickness of the sponge wall is penetrated by wide and irregular tunnels, the diarhysis, which freely intercommunicate and form a labyrinthine system of passages. These are in most places 2—4 mm. wide, and are separated from one another by irregular, branching and anastomosing septal trabeculae of 1.5—3 mm. thickness. The passages open outwards by the external apertures, already referred to, and internally by a set of gastral apertures of a similar appearance. Both gastral and canal surfaces are dense-looking and porous, some of the pores being relatively larger than others, and altogether present small pit-like depressions and a rough appearance, similar to that usually shown by choanosomal surfaces of other Hexactinellids.

The external incurrent apertures of the diarhysial canal system are mostly seen to be provided with a delicate cobweb-like or cribrate soft tissue. This is usually situated, not on the level of apertural edge, but a short distance within it, thus occupying a more or less depressed position. The membrane with its open meshes looks much like the ordinary dermal membrane, and the presence in it of one or two, round and conspicuously large central meshes may give it an iris-like appearance. The internal canal passages as well as the gastral apertures are traversed across, here and there, by fine trabeculæ of the soft tissue. The trabeculæ, distinctly observable under the hand-lens, are at places membranously expanded; at other places they may form a cobweb-like reticulum.

Spiculation. — It may be well to state here at once that the species seems to be one of those Dictyonina which are entirely destitute of both dermal and gastral skeletal layers. I regard the absence of these layers in the specimen under consideration to represent its natural state. They either do not come at all into development or, if ever they did develop at an early ontogenetical stage, must have since been lost as a normal process. The soft cribrate membrane at the entrances into diarhysial canals, I have found to be supported by no special spicules of its own, but by such scopules and uncinates as are met with in other parts of the sponge.

The external most superficial dictyonal beams and the spikes arising from each of the superficial nodes have attained an unusually strong degree of development and give to the surface the remarkable crusty appearance before described (pl. XXIII, fig. 3, 4). Possibly this may have some relation to the disappearance of the dermal covering layer. In most parts of the surface the meshes of the dictyonal layer in question are represented by roundish, oval or round-cornered irregular spaces or pores of various sizes, generally 35—275 μ in width. The robust and relatively short beams may be 60—150 μ thick. The spikes have taken, manifestly by excessive superaddition of the siliceous matter, the quite unusual form of a broad hemispherical or knob-like swelling up to about 220 μ in diameter at base. Only occasionally some of them remain in the form of thick finger-like and roundly ending processes, say, 220 μ long and 120 μ or under in thickness. The particular beams in question and the swollen spikes are thickly beset all over with small but pronounced tubercles of a conical shape. These show certain regularity in their arrangement, so that those on the excessively swollen spikes are seen to form linear rows that run in meridional, transverse, as well as oblique directions. On the inner surface of

the beams the tubercles are less crowded than on the outer and lateral, but are somewhat more prominently developed. Near the oscular margin, the superficial dictyonal reticulum is in a relatively retarded state of development, being made up of comparatively slender beams and spikes. The same holds good for the reticulum that directly make up the wall of diarhysial canals. Following these inwards from the external aperture, the spikes are at first papilla-like or thickly finger-like with irregular tuberculation (pl. XXIII, fig. 5) but grow still more slender in the deeper parts of the canals; at the same time the spike-bearing nodes and the connecting beams diminish in bulkness, while the tuberculation on surface becomes less profuse. In the deepest parts of the canals as well as on the gastral wall (pl. XXIII, fig. 7), the superficial reticulum is quite irregular as a layer; here the spikes, say up to 150 μ long by 12 μ thick, are generally slenderly finger-like and rather sparsely tubercled. They are directed in no definite way. The still more sparsely tubercled, connecting beams in those parts do not exceed 50 μ in thickness.

The deeper main mass of the dictyonal skeleton (pl. XXIII, figs. 5—7) consists of a three-dimensional network of comparatively slender and more or less tubercled beams, which are commonly 20—50 μ thick, but grow considerably thicker towards the sponge periphery, attaining their maximum development in the outermost position. The dictyonal meshes are in part quadrate or subrectangular, mostly measuring 165—400 μ in the length of sides, and in part irregularly shaped. The tuberculation of internally situated beams is on the whole not dense; it is frequently even quite sparse and scattered. The individual tubercles are mostly conspicuous and of a lowly conical shape. At certain positions in the skeleton I have found them developed, several together at a time, into distinct spines which gave to the beams a conspicuously spiny appearance (pl. XXIII, fig. 5). The spines are either erect or gently bent like the cock's spur, and may reach a length of 30 μ or more.

Of the loose spicules, the scopule is common all along the bounding surfaces, especially along the canal and gastral surfaces (pl. XXIII, fig. 7). It is moderately large, measuring from 800 μ to nearly 1 mm. in total length. The shaft, under 8 μ thick in the middle of length, is very finely rough towards the inner end. The umbel of prongs at the other end (pl. XXIII, fig. 9) is of an elongate conical shape, 100—130 μ long and 65—80 μ broad at the extreme end. It is made up of 5 or 6, nearly straight, slender prongs which terminate simply rounded without a distinct cap or a bulbous swelling. The prongs are thickest at base where the surface is smooth; distally they narrow very gradually, at the same time becoming finely rough on account of the presence of exceedingly minute tubercles, which in the more distal parts take the form of retroverted spinules. Towards the outer end the prongs are again just slightly thickened. The extreme rounded tip is bald, surrounded by the last whorl of the barbs. The scopules may project out of the sponge surface with their umbelled end, together with some rhaphidial uncinates.

Uncinates of a small size but with distinctly developed, though not numerous, barbs, occur in some number in the deep parts. They may be about 120 μ or more long and about 8 μ thick in the thickest part which lies nearer to one end than to the other. The barbs are slender and slant away but little from the shaft surface. Of far more frequent occurrence are long and slender uncinates in which the barbs are entirely undeveloped or are at the most represented by obsolete bracket-like indentations of the surface. They are straight and oxea-like,

tapering uniformly toward both ends. The larger ones may be 880 μ long by a thickness of under 5 μ; the smaller ones run down to 300 μ in length and are of rhaphidial fineness. The needle-like spicules in question are found either singly or in bundles, usually in vertical orientation to bounding surfaces of the wall.

The only kind of hexaster present is a small and delicate tylohexaster with long principals (pl. XXIII, fig. 8), of exactly the same appearance as the one found in *Hexactinella*. It occurs commonly in all parts of the sponge, at places lying near together in numbers. Diameter 70—89 μ. From the somewhat swollen central node there arise slender principals generally 20—30 μ long, each ending with a tuft of 8—10 or more fine terminals. The tuft is 14—17 μ long, and from $^2/_3$ to nearly $^1/_2$ as long as the principal it belongs to. It is of an elongate bell-like shape, very gently expanding towards the outer end. Each terminal ends with a very minute knob which is not always distinct and may scarcely be recognizable under a low magnification.

Besides the above described type specimen, a few more small fragments of evidently the same species were obtained at the same station (Stat. 267).

Also from Stat. 226 in Banda Sea, between Schildpad and Lucipara Islands, there are some crust-like fragments which seem to represent the same species. They are in the form of small and thin irregular plates perforated by roundish gaps of 2—5 mm. width, with interspaces of 1—4 mm. width between them. Without doubt they represent the peripheral layer of the skeleton severed off from the inner parts, the mesh-like gaps being nothing else than entrances into the diarhysial canals. The outermost layer of excessively thickened dictyonal beams and spikes shows exactly the same characterization as in the type specimen, excepting the shape frequently assumed by the thickly set tubercles of the surface. At places these are indeed simply conical as I always found them to be in the type specimen; but in most other places they are of an irregular or variable shape like a little simple ridge or star-like ridges radiating from a central point. Consequently the surface at those places appears finely wrinkled, and, where the wrinkles have extensively joined with one another, a reticular pattern of fine ridges is the result. These conditions of the surface relief may be regarded as having been derived from separately standing tubercles by the superaddition of siliceous matter at a later period of individual life.

Remarks. — This new genus and species seems to be most nearly related to *Hexactinella*, as indicated by the agreement in gross structure and in the shape of the tylohexaster. A certain relationship undeniably seems to exist between it and *Gymnodictyum* among the Euretidae, as may be gleaned from not only the absence of covering spicular layers in both, but also from the resemblance in character of the scopule and the occurrence of the same form of tylohexaster. *Heterorete pulchra* Dendy (1916) is still another Euretid known to be devoid of the covering spicules, but this is apparently a widely different form.

Genus **Anomochone** n. g.

Irregularly funnel-like with tendency to divide into branches, or subglobose; attached by compact base. Besides terminal osculum there are several lateral oscula. Diarhyses slit-like

or narrowly labyrinthic. Dictyonal framework consisting of tubercled beams and of pronounced swollen spherical, multiradiate nodes. Superficial nodes of dermal surface forming on the external side tubercled bosses, one at base of each small spike.

The distinctly diarhysial character of the canal-system marks this genus as one of the Tretodictyidae. The incompleteness of our knowledge regarding the loose spicules makes its relation to other genera of the family difficult to determine. As the most important distinctive character of the genus as now known, should be given the spherically swollen nodes of the dictyonal framework. In this respect it closely resembles certain species of *Eurete* and *Pararete*, as e. g., *Eurete schmidti* F. E. Sch., *E. trachydocus* n. sp., *Pararete farreopsis* Cart.

I refer to this genus the following two species from the Siboga collection.

1. *Anomochone expansa* n. sp. (Plate XX, figs. 9—16. Textfigs. 33, 34).

Stat. 251. 5° 28′.4 S., 132° 0′.2 E. 204 m. 6 specimens.

Diagnosis. — Moderately large stock, irregularly funnel-like, tending to divide above into tubular branches; with 2—4 mm. thick wall forming tuberous outbulgings, besides being folded lengthwise, so as to give a very irregularly lobate shape to cross-sections of body as well as to terminal osculum. With a number of roundish lateral oscula (up to 4 mm. diameter), most of which face downwards owing to their being situated on the underside of hood-like tuberosities. Skeleton pumicose in the older parts, but passing above in the younger parts to a vermiculated-like structure in which its composition out of septa and intervening diarhysial slits is manifest. Dictyonal beams and nodes with characterizations as given in the generic diagnosis. Uncinates in part rhaphidial. Scopule without bulbous terminal swelling to end-prongs. Other loose spicules not known.

Description. — Of this species six specimens, besides some small fragments, were obtained by the Siboga at Station 251, south of Kur Island in Banda Sea. Of these I have chosen four for description in the following lines, calling them specimens A, B, C and D. Unfortunately all, except one (spec. D) which has preserved some loose spicules in a sparse quantity, are completely macerated individuals which must have been long since dead at the time they were collected.

Specimen A is a moderately large, irregularly funnel-shaped skeleton, standing on the contracted end by a compact and solid base. It is shown in natural size in pl. XX, fig. 9 in lateral view, in fig. 10 as seen from below, and in fig. 11 as seen from above. Obviously the specimen is nearly entire, only some insignificant portions of the wall at the oscular margin having been lost by breakage. The wall 2—3.5 mm. or more thick, is very irregularly folded longitudinally, so that the body in cross-sections is of an irregularly lobate shape. The folding is deepest in the uppermost parts, making the large terminal osculum assume a deeply indented, almost branching-like outline (pl. XX, fig. 11). Conformably to the external shape, the gastral cavity is an extremely irregular space. A short distance from the oscular margin it assumes the character of almost labyrinthine passages, owing to frequent occurrence of irregular trabecula-like connections between approximated opposite points of the wall. Lateral oscula of a roundish shape and 2—4 mm. in diameter are present in numbers on the sides of the sponge. A few of

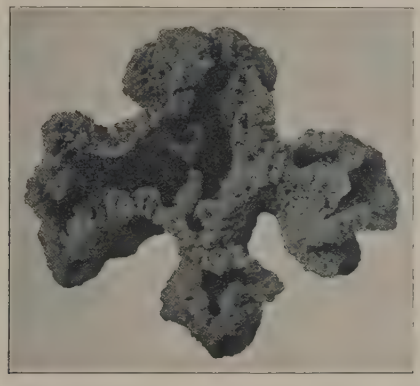
them in the upper parts of the calyx are either simple and fenestra-like or are crater-like apertures at the truncate end of short annular projections of the wall, while the rest and by far the greater number of them are characterized by being situated on the underside of parietal outbulgings, which are thus of a hood-like shape with the aperture facing below; the result being that the lateral oscula so situated are brougth into full view only when the sponge is seen from the side of the base (pl. XX, fig. 10).

As seen on the external surface, devoid of the dermal lattice which should have originally covered it all over, the compact base passes above into the wall of a porous or pumicose character, consisting of a dense skeletal tissue which is penetrated by numerous closely situated canals of various calibers. The wider canals open by pores of a somewhat irregular shape, not exceeding 1 mm. in width. This pumicose condition obtains in the lower two-thirds of the sponge but very gradually changes above and towards the terminal oscular rim into still another condition which may not improperly be called vermiculated-like, in that the wall in those parts appears traversed by worm-burrow-like passages of varying width usually not exceeding 0.5 mm. The passages, it is easy to see, are deep slits — diarhysial slits in fact in part extending right through the entire thickness of the skeletal wall and dividing this into septa up to 1.5 mm. thick on the external sponge surface. The septa are irregular, in part column-like and in part more or less plate-like, parallel strips of dense dictyonal tissue, running somewhat meanderingly but on the whole longitudinally so as to reach the oscular margin nearly vertically. They are joined together by transverse connectives in the form of either isolated cross-beams or truss-like combinations of dictyonal beams. In the young parts of the wall, as in the marginal zone, the connectives are mostly relatively thin and inconspicuous, besides occurring at comparatively wide intervals; hence the septa are here distinctly recognizable as such, and the wall thus appears vermiculated-like owing to the diarhysial slits that intervene between them, similarly as in *Hexactinella* species or in *Tretodictyum tubulosum*. Lower down on the wall, i. e., in its older parts, this structural appearance gradually becomes obscured and gives place to the pumicose condition before described, due in part to the increase in number as well as thickness of interseptal connectives and in part to the addition of a superficial dictyonal layer which is perforated by apertures, directly and freely leading into the diarhysial spaces now greatly narrowed by the segmentation of dictyonal parts. — On the gastral wall the septa present themselves in most parts as longitudinally running bands or ridges (up to 2 mm. or over in width), connected together at intervals by transverse dictyonal bridges which divide the slits between them into series of separate openings in linear arrangement. At certain other places of the gastral surface there exists a covering dictyonal layer of indefinite extent, joining together the inner edges of a varying number of consecutive septa. The layer may be uniformly and minutely meshed or may show some specially large apertures for the outflow of water directly from interseptal diarhyses. The trabecula-like portions before mentioned, which divide the deeper parts of the gastral cavity into irregular passages, seem to be hypertrophic formations of the covering dictyonal layer of the gastral surface.

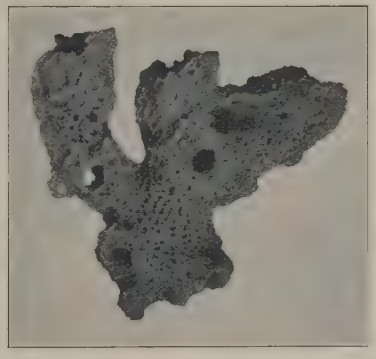
Specimen B (pl. XX, fig. 12) is essentially like the above specimen in all respects. The upper part of the stalk-like base sends out a lateral branch, but this fuses soon again with the main body. As seen from above (textfig. 33), the body outline presents four cruciately disposed

projections. One of the tuberous exterior projections represents the fused upper end of the lateral branch just referred to. The three remaining projections are manifestly outbulging folds of the wall, one of them being apparently in the incipient stage of developing into a new branch. Here again in the gastral cavity there exist a few trabecula-like connections between opposite walls at certain places where these approach each other by their being folded in. On the side of the sponge open lateral oscula in fair number; but the majority of these are again not visible in the lateral view of the sponge, being situated below hood-like protuberances and so facing downwards.

Specimen C (textfig. 34) is a branching fragment lacking the basal parts. In the lower parts it is an irregular tube about as thick as one's finger. Superiorly this divides into three ends, each of which shows a terminal osculum of an irregularly oblong shape. Several lateral oscula open on the sides. The wall may be described as being honey-combed by diarhysial



Textfig. 33. — *Anomochone expansa* n. g., n. sp. Top view of specimen B, shown in lateral view in Pl. XX, fig. 12. Natural size.



Textfig. 34. — *Anomochone expansa* n. g., n. sp. Specimen C. Natural size.

passages, obscurely showing in certain parts its composition out of septa which run in the main longitudinally.

Specimen D is a fragment representing a large segment of the wall of a sponge which was presumably of an expanding calyx-like shape at the part, though this cannot be exactly told. It includes a long stretch of the terminal oscular margin, which is nearly round-edged. The thickness of the wall in most parts may be given at 3—4 mm. Seen on the dermal side (pl. XX, fig. 13), there exist some lateral oscula of a roundish shape, 3—4 mm. in diameter. They are in part situated on top of boss-like prominences. The gastral side presents much irregularities, in that the lower parts of the gastral concavity is converted into a complex of irregular spaces, owing to the occurrence there of a dictyonal growth with several pillar-like or broadly bridge-like connections to the wall.

Structurally the skeleton of the specimen is essentially identical with the upper parts of specimen A. On the dermal side each septum of about 1 mm. average thickness appears as being cut up by transverse incisions into a series of pieces of various lengths; so that the diarhyses, less than 0.5 mm. in witdth, form a reticulating system (pl. XX, fig. 13). The resemblance in structural appearance between the external protuberances with lateral osculum

and the branch ends of the skeleton of *Tretodictyum tubulosum* may be said to be nearly complete. The gastral surface is of a somewhat different appearance. In certain parts it exhibits longitudinal septa and intervening series of excurrent apertures in a more or less distinct way; in other parts there exist a covering layer of close-meshed dictyonal tissue continuously extending over several septa and interseptal canals. A large part of the terminal oscular edge consists of a continuously compact tissue, though in other parts of it this condition does not exist and the septa run right up to the edge, each to end freely there.

Spiculation. — The dictyonal framework (pl. XX, fig. 14) consists in most parts of sparsely microtuberculate beams, of which usually more than six — up to eight or nine — join together to form a multiradiate node. The microtubercles are irregularly distributed; they are more sparse on some than on other beams. The beams are 30—50 μ thick between nodes. The meshes they inclose are generally triangular with rounded corners and measure 110—275 μ in the length of sides. The nodes are distinctly swollen, measuring 100—140 μ in diameter. Those superficially exposed on the dermal side are hemispherical externally, show on surface tubercles somewhat larger than those on beams, and bear at the pole each a short, finger-like and rather sparsely tubercled spike. — On the gastral surface of the wall the dictyonal framework may greatly differ in character from the above description; this is especially true of the dense-meshed covering layer of the surface (pl. XX, fig. 15). Here the reticulum is quite irregular, the beams very frequently joining together in a random way outside of true nodes, and consists of beams which run down to 20 μ or less in thickness and show a dense and rather prominent tuberculation; the nodes are scarcely or not at all swollen. Ankylosed to the reticulum may frequently be found some small rough hexactins of 100 μ and over in axial length and also some rough slenderrayed pentactins (seldom hexactins) of a moderately large size (220—340 μ axial length).

Of the loose spicules, the following were discovered adhering to the skeleton of specimen D, which, to judge from the condition of axial canals in the beams, was probably living at the time of its capture: 1) uncinates about 1 5 mm. long and 16 μ thick, with flatly appressed barbs in a rather close distribution; 2) smooth or nearly smooth oxea-like needles about 300 μ long or shorter, which are in all probability micro-uncinates; 3) scopules 460—550 μ long, each with 5 or 6, obsoletely rough and 45—55 μ long end-prongs without terminal swelling (pl. XX, fig. 16). Further, there were met with a case or two of another scopule form 330 μ long and with 4, 60 μ long end-prongs terminating with distinctly bulbous knob; but it is doubtful if this really belonged to the specimen. No trace of dermalia and hexaster has been discovered.

2. *Anomochone globosa* n. sp. (Plate XIX, figs. 20—25).

Stat. 251. 5° 28′.4 S., 132° 0′.2 E. 204 m. 3 specimens.
Stat. 260. 5° 36′.5 S., 132° 55′.2 E. 90 m. 4 fragments.

Diagnosis. — Small, subglobose or ovoid, thick-walled, attached by short stalk-like base; above with one or more terminal oscula leading into irregular-walled gastral cavity; some small lateral oscula present. Wall pervaded by a system of labyrinthine diarhyses, and made up of branching and anastomosing, cancelli-like skeletal trabeculae generally 0.5—1.5 mm. thick. On external sponge surface, diarhyses open either by mesh-like apertures or by worm-

burrow-like clefts. Dictyonal framework with pronouncedly swollen multiradiate nodes, most of which show a number of small wart-like swellings beset with punctiform microtubercles. Loose spicules unknown.

Description. — The three specimens of this new species from Stat. 251, south of Kur I., Banda Sea, are unfortunately all thoroughly waterwashed individuals, but are otherwise in a good state of preservation. They will be called specimen A, B and C.

Specimen A (pl. XIX, figs. 20, 21) is of a depressedly subglobose shape, 26 mm. in diameter and 20 mm. high. On top and slightly eccentrically situated is the terminal osculum of 10—13 mm. diameter (fig. 21). Below, there are two short stalk-like bases for attachment to the substratum. — Specimen B (pl. XIX, figs. 22, 23) is a transversely elongate ovoid mass 29 mm. long. On top there are two terminal oscula side by side (fig. 23). The two gastral cavities they lead into, are separate though connected with each other by means of diarhysial canals that intervene between them. Below, the sponge stands on a short base, by which it appears to be attached to the body of another much smaller and quite incompletely developed individual (fig. 22). — Specimen C (pl. XIX, fig. 24) may be compared in shape to a small thick-walled goblet, 21 mm. high and 19 mm. in diameter of body.

All the specimens are in general appearance very much like *Tretodictyum pumicosum* n. sp. (pl. XIX, figs. 8, 9). As in that species or in *Hexactinella? spongiosa* n. sp. (pl. XIX, figs. 5, 6), the skeletal wall consists of branching and anastomosing, rudely cancelli-like trabeculae of dense dictyonal tissue. The trabeculae are 0.5 mm. and over in width. The intercommunicating labyrinthic spaces between them are the diarhysial canal system. The external openings of this on the dermal surface appear either as meshes of an irregular septal network or as more or less sinuous clefts that lend a worm-eaten-like appearance to the parts. Alike in all the three specimens a limited number of the external mesh-like apertures are distinguished by their relatively superior size (up to 2 mm. across) and are at the end of direct passages from the gastral cavity. Such apertures will probably be found to open freely — unlike all other smaller apertures which, if the dermal lattice were preserved, will be found covered over by it — and may be regarded as lateral oscular openings of secondary origin. The primary osculum on top of body is of a lobulate or irregular outline. The gastral cavity is deep; its wall irregularly surfaced, some skeletal trabeculae projecting more or less like a ridge or a bridge into the cavity, which may in part be even incompletely divided by them into adjoining chambers. The four fragments from Stat. 260, W. of Great Kei I., are so small and incomplete that a description of them seems useless.

Spiculation. — The dictyonal framework (pl. XIX, fig. 25) is similarly characterized as that of *A. expansa*. The nodes are pronouncedly thickened to a spherical shape. They are generally multiradiate. In relation to these facts the beams are relatively short and the meshes generally triangular in shape. The nodes measure 110—165 μ across. Most of them are distinguished by having on surface small warts beset with punctiform microtubercles in a varying number, which warts remind one of the similar swellings on the dictyonal nodes of *Myliusia*. The warts are more numerous on some nodes than on others. They may sometimes be suppressed, in which case the microtubercles occur simply in groups on the general nodal surface. Sometimes the microtuberculation on an entire node is quite or nearly simple as in

A. expansa. The beams are 35—65 μ thick and usually sparsely covered with irregularly distributed microtubercles. The spikes are small. The meshes have rounded corners and measure mostly 110—200 μ in the length of sides. — On the gastral side of the wall the microtuberculation on dictyonal beams is denser and stronger than in the more peripheral parts. In certain parts of the gastral surface the dictyonal meshwork is quite irregular, accompanied by frequently occurring false nodes which are not swollen.

Loose spicules could be discovered in none of the specimens.

Family Aulocalycidae n. fam.

Tretodictyidae partim, F. E. Sch., 1886, p. 78; 1887, pp. 327, 398.
Dactylocalycidae partim, Ij., 1903, p. 25. — F. E. Sch., 1904, p. 180.

Scopularia with wall not canalized, though extradictyonal epirhysi and aporhysis may occur. Skeletal framework quite irregular-meshed, being made up of hexactins which are oriented without regularity in relation to one another and have rays frequently much elongated and curved, the rays intersecting one another at various angles and fusing together where they come into contact at points of intersection or where they are laterally apposed or terminate by abutting on others; proximately running rays often connected by synapticulae. Scopule absent or present.

The genera and species which I place together under this new family are as follows:

1. *Aulocalyx irregularis* F. E. Sch.
2. *A. serialis* Dendy.
3. *Rhabdodictyum delicatum* (O. Schm.) F. E. Sch.
4. *R. kurense* n. sp.
5. *Euryplegma auriculare* F. E. Sch.
6. *Tretopleura candelabrum* n. g., n. sp.
7. *Fieldingia lagettoides* S. Kent.

The body may be vasiform or tubular with a main osculum above and a number of lateral oscula on the sides (*Aulocalyx*, *Rhabdodictyum*) and sometimes semitubular, representing a lateral segment of a vase (*Euryplegma*). *Tretopleura* is known from macerated fragments only, so that nothing definite can be said of its general habitus or of its loose spicules. *Fieldingia*, so far as known, appears to be an aberrant form with an almost spherical body in which a gastral cavity and osculum cannot be distinguished.

Distinct canals are known only in *Euryplegma* and *Tretopleura*, both of which exhibit well-developed epirhytic and aporhytic canals of apparently extradictyonal character, though not exactly identical in the mode of their origin in the two genera. In *Euryplegma* the canals seem to develop from, or in connection with, the grooves between the longitudinal folds of its skeletal layer, while in *Tretopleura* they seem to be depressions which were left behind concomitantly as the skeletal wall increased in thickness by growth, both externally and internally, from a much thinner basic layer.

The most notable point in the characterization of the family lies in the extremely irregular construction of the skeletal framework. This is due to the absence of regularity in the orientation of the hexactins in relation to one another, to their rays being frequently prolonged to an unusual length and curved in their course, to their intersecting one another or terminating by abutting on others at various angles, and finally, to the frequent formation of synapticulae, like the step-bars of a ladder, between proximately running rays. A large number of dictyonal nodes are not hexactin centres but simply points of fusion at intersections or where a ray terminates by joining another, or sends out synapticulae. At places two rays from different hexactins may be laterally apposed to each other and fused into a single beam for a variable length, as indicated by the axial canals contained within.

The dermalia and gastralia are probably always pentactins. Common to all the genera seems to be the discohexaster. In *Fieldingia* alone oxyhexaster is known to occur in addition. The uncinate is known to occur in *Fieldingia* and *Rhabdodictyum*; and the absence of its record in regard to other members of the family, where this is not due simply to the defective state of the specimens examined, cannot but be the result of its secondary loss during the phylogeny of the forms concerned.

The scopule is known from *Fieldingia* alone. It seems pretty certain that the same spicule does not occur in *Aulocalyx*, *Rhabdodictyum* and *Euryplegma*, since these are all forms of which the loose spicules have been studied with considerable care. Here again, I assume the absence of the scopule to be due to its secondary loss during the evolution of those genera, although I am not prepared to adduce direct evidence for it. *Tretopleura* must be left out in questions relating to loose spicules, being founded on completely washed-out fragments. It is referred to the Aulocalycidae solely on the strength of the structure of its dictyonal framework which agrees with that of the other genera referred to the family.

Time was when the three genera *Aulocalyx*, *Rhabdodictyum* and *Euryplegma* were assigned by F. E. Schulze (1887, 1897) and by myself (1898; 1903, p. 20) to the Lyssacinosa, owing to the exceedingly irregular reticulation of their dictyonal framework in contrast to the more or less regularly meshed structure of same in most Dictyonina, and also to the fact that neither scopule nor uncinate was discovered in them. Subsequently *Aulocalyx* and *Euryplegma* were referred by me (1903, p. 25) to the dictyonine family Dactylocalycidae, which procedure was agreed to by F. E. Schulze in the "Valdivia" report (1904). In that report the author gave a list of living Hexactinellid genera, but left *Rhabdodictyum* altogether out of it, presumably taking it for a doubtful form which offered difficulty even in determining if it was lyssacine or dictyonine. There can now be scarcely a doubt that *Rhabdodictyum*, together with the two other genera referred to, is a genuine dictyonine form.

Now the family Dactylocalycidae, as last given by F. E. Schulze in the "Valdivia" report, consisted of the six genera: *Dactylocalyx*, *Margaritella*, *Myliusia*, *Auloplax*, *Aulocalyx* and *Euryplegma*. Of these, the three first mentioned genera are now removed to the *Euretidae*, and the fourth (*Auloplax*) to the *Tretodictyidae*. So that, there remain *Aulocalyx* and *Euryplegma* to be referred to a proper family, the old family designation Dactylocalycidae being no longer available.

Aulocalyx and *Euryplegma* seem to agree with each other in being without intradictyonal

canals, in the peculiar way and manner in which their dictyonal skeleton is constructed, and in the absence of scopules and uncinates. At the same time both the genera stand at marked variance from any of the established dictyonine families with respect to the character of the skeletal framework. It will be conceded by all, I think, that either one of them deserves to be made the type of a distinct family, and that the other can be left in association with it in the same. As a third genus of that family as I now feel convinced, should be added *Rhabdodictyum*, which from its macroscopic characters, may perhaps be regarded to be even more nearly related to *Aulocalyx* than *Euryplegma* is. Further, *Tretopleura* and *Fieldingia* appear also includible in the family, relying upon the peculiarly irregular construction of the non-canalized skeleton as the guiding mark of primary importance.

Differential key to the genera.

A. Skeletal wall without formation of epirhysis and aporhysis.
  a^1. Gastral cavity manifest, with main osculum above and a number of accessory oscula on lateral wall.
    a^2. Body vasiform, with lateral wall longitudinally folded. With rhopalaster (large hexaster with terminals distally thickened and beset with numerous retroverted spines) . . . . . **Aulocalyx** F. E. S., 1886.
    b^2. Body tubular, or anastomosing tubes; lateral wall not longitudinally folded. With spirodiscohexaster **Rhabdodictyum** O. Schm., 1880.
  b^1. Gastral cavity and osculum not manifest. Body irregular or almost spherical; externally covered by a laminated cortex, internally with small knot-like dictyonal masses in connection with main skeletal beams . . . . . **Fieldingia** S. Kent, 1870.
B. Skeletal wall with epirhysis and aporhysis of an apparently extradictyonal origin.
  c^1. Skeletal layer much folded longitudinally, and the two systems of canals are apparently parts of external and internal grooves between the folds. (Body a semicanal, representing a lateral segment of an erect tube) **Euryplegma** F. E. S., 1886.
  d^1. Skeletal layer not folded in the above way, but consisting of a basic layer, external to which the two canal systems seem to have originated as it grew in thickness both outwards and inwards. . . . . **Tretopleura** n. g.

In the "Siboga" Collection are represented the two genera: *Rhabdodictyum* and *Tretopleura*, each by new species.

Genus **Rhabdodictyum** O. Schmidt, 1880.

Rhabdodictyum O. Schmidt, 1880, p. 46.

The present genus is characterized by the presence of a spirodiscohexaster, similar in appearance to those known from certain Euplectellids (*Saccocalyx*, *Rhabdopectella*). The genus is

probably not far removed from *Myliusia* but distinct from it, especially in the regular reticulation of dictyonal beams (frequent occurrence of false nodes), in the absence of swollen nodes and in the tendency of forming continuous longitudinal fibers. This genus is also possibly nearly related to *Aulocalyx*, resembling it in dictyonal elements and their mode of ankylosis.

Two species of the genus are known at present: *Rh. delicatum* and *Rh. kurense.*

Rh. delicatum, the only species hitherto known of the genus, was described by O. SCHMIDT, 1880 (p. 46, pl. VI, fig. 1 and pl. VII) from Bequia (one of the Lesser Antilles), 1591 fms. He mentioned two varieties A and B; of these, as pointed out by F. E. SCHULZE (Chall. Rep., p. 106), A is perhaps identical with SCHULZE's *Dictyocalyx gracilis* and B remains to O. SCHMIDT's credit. The "Challenger" (1887, p. 107, pl. XX) obtained three wholly macerated specimens in the neighbourhood of Bermudas, 1075 fms. There were placed in the Euplectellidae by F. E. SCHULZE under O. SCHMIDT's name *Rhabdodictyum delicatum.*

1. *Rhabdodictyum kurense* n. sp. (Plate XXIV, figs. 1—12).

Stat. 251. 5° 28′.4 S., 132° 0′.2 E. 204 m. 7 specimens or fragments.

Diagnosis. — Irregular, branching and anastomosing tubes of varying width and rather irregular outline in cross-section; measuring 14 mm. across in the widest part; wall about 1 mm. thick in average. Besides some main (terminal) oscula, there exist a number of smaller (up to 4 mm. diameter) and roundish lateral oscula of which some are simple apertures in wall, while others open at end of short tube-branches. Dictyonal skeleton irregular-meshed, certain beams forming continuous longitudinal fibers, not swollen at nodes; beams with microtubercles in transverse rows or in small groups on common ridge-like or wart-like elevations of surface. Spikes present on superficial nodes but not in all. Dermalia and gastralia faintly rough or nearly smooth pentactins. Characteristic hexaster a floricome-like spirodiscohexaster with each bunch of terminals sinistrally twisted in the basal parts.

Description. — The species is founded on seven specimens from the Siboga Station 251, a spot to the South of Kur Island in Banda Sea.

Unfortunately all the specimens are more or less incomplete, but are yet sufficiently characterized to allow safe conclusion being made as to their specific identity. Not improbably they are pieces broken off from one and the same stock. As representative specimens for giving an idea of the macroscopic features I have selected the three shown in pl. XXIV, figs. 1—3. The specimen fig. 1 is in all appearance a nearly, if not quite, complete stock of a small size. It may be described as an irregular tube of about 8 mm. diameter in the thickest parts, bearing numerous tube-branches (5 mm. and under in diameter) and oscular openings. The tube wall nowhere quite reaches 1 mm. in thickness. At one place, two of the branches have coalesced at their ends, inclosing a mesh-like space between them. On the outside of this junction point and also at one end of the main tube, there are the two largest of all the oscular openings. The remaining oscula are either simple roundish openings on lateral tube wall or are terminally situated at outer end of short tube-branches. There exist ample evidences showing that the simple lateral oscula are at first mere indentations in the margin of terminal oscula, which indentations later become closed all around by the growing margin and thus

change into a roundish gap in the wall. Lateral oscula so formed may persist in the original simple state; more frequently they assume terminal position in that their margin becomes raised into a ring-wall which is nothing else than a tube-branch in the first stage of development. The little stock in question seems to have been attached to the substratum by small tubular pedicles, of which more than one can be distinguished. — Fig. 2 shows the cleansed skeleton of a fragment representing the free end of a main tube. The main osculum at the upper end measures 11 mm. × 14 mm., which dimensions are about the maximum attained by a tube in the specimens in hand. The wall is on an average about 1 mm. thick. The margin of the main osculum exhibits at opposite points two deep indentations, which represent early stages in the formation of lateral oscula. Lateral oscula of a roundish shape, varying 1.5—4 mm. in diameter, occur in numbers, partly as simple perforations and partly with the marginal edge extended outwards in varying degrees in the form of a ring-wall or a short tube-branch.

The specimen, shown in fig. 3, is the largest piece in the collection. It is however only a portion of a stock, broken off at the time of capture. Of what shape or size the original stock was cannot be ascertained but possibly it was an *Eurete*-like mass. The piece, as it is, consists of some branching and anastomosing tubes of varying shape in cross-section. Roundish lateral oscula, 1.5—3 mm. in diameter and either simple or surrounded by ring wall, exist as in the other specimens described above. Towards the free end the main tubes expand more or less, and at the same time become laterally compressed, giving to the parts an irregularly flattened appearance not unlike that of a cockscomb (*Celosia*). Along the distal edge of the crest opens the terminal osculum, not a roundish opening, but an elongate sinuous gap which lends to the parts an irregularly trough-like appearance. The trough measures 4—7 mm. across. The wall is about 1 mm. or slightly over in thickness; it is bluntly edged at margin. There exist unmistakeable signs of the elongate terminal osculum becoming at places divided into separate oscula by the folding in and subsequent fusion of opposite marginal walls, thus giving rise to a bridge-like connection over the trough. — A delicate dermal layer, of which the more or less regularly quadrate skeletal meshes measure commonly 275—430 μ in length of sides, covers the external surface. Close beneath that layer the choanosomal surface shows crowded, large and small epirhysial apertures, up to 600 μ or thereabout in width. In fact the macroscopic appearance of the sponge structure offers no marked difference from that of certain *Eurete* or *Pararete*. The gastral surface is of a similar appearance as the external; only the gastral layer forms less continuous sheet than the dermal and hence aporhyses are frequently seen to open directly outwards. — Finally I should mention the occasional occurrence of certain lateral oscula which have become secondarily filled in and closed by proliferation of the sponge tissue. Such obdurate oscula I have also observed on completely washed-out skeletons, in which the opening appeared to be either completely or partially filled in by dictyonal reticulum of apparently later formation than the surrounding parts of the skeleton.

Spiculation. — Examined under the lens, the dictyonal skeleton appears in the superficial parts to consist of quite an irregular reticulum of beams; more internally in the wall a set of dictyonal beams is seen to constitute long and singly running longitudinal fibers, but again without giving rise to regularly shaped meshes, since the rest of the beams intersect or join them at varying angles and in no definite direction. In the longitudinal fibers the singly

running axial canal can often be traced continuously for 2 mm. or over, showing that we have to do with rays greatly prolonged in the direction indicated. The dictyonal beams are generally 40—80 μ thick, occasionally reaching up to nearly 100 μ. On the whole they are somewhat stronger in peripheral than in internal parts of the wall. Anyway the strongest beams occur in or near the periphery, so that it is not difficult to distinguish between dermal and gastral surfaces of the skeleton after once losing the orientation. The nodes are not specially thickened. Some of the shorter dictyonal beams are simple synapticulae without axial canal. Such synapticulae are similarly tubercled on surface as those beams which are traversed by axial canals. On surface the beams show peculiar tuberculation which is not unlike that in *Diapleura maasi* Ij. Small rounded tubercles are generally arranged either in short transverse single rows or in small irregular groups, usually of a more or less transversely elongate shape. These rows and groups are separated from one another by smooth interspaces, and are moreover gently elevated from the general surface, so that there arise more or less distinct ridge-like or wart-like major prominences which are studded on top with the microtubercles. Spikes do not form a prominent feature of the skeleton. Many of the superficial nodes on both dermal and gastral sides are entirely without a spike or show but an indication of it in the form of a low tubercled swelling. Distinct spikes occur here and there in irregular distribution. Those of the dermal side are frequently strong tapering pegs round at tip and showing on surface whorls of microtubercled warts in close succession (fig. 6); they may be 400 μ long and 100 μ thick near base. Spikes occasionally seen in other parts of the wall are of far more insignificant dimensions.

The dermalia are pentactins without a trace of a distal ray (fig. 7). Tangentials 275—400 μ long, 13—19 μ thick at base, subterminally always rough, for the rest either nearly smooth or with a sprinkling of obsolete microtubercles. The unpaired proximal ray about as long as or somewhat longer than tangentials, usually nearly smooth except toward the free end. The gastralia are quite similar to the dermalia.

Uncinates do occur, though rarely. There are isolated cases of the occurrence of fine uncinates of usual character, but I am inclined to regard them as extrinsic. Scopules seem to be entirely wanting in the species. I believe that they do not occur in the species, from observations on sections of the wall in an excellent state of preservation.

Characteristic hexaster of the species is the floricome-like spirodiscohexaster, alike of which has hitherto been known from *Rhabdodictyum delicatum* (O. S.) F. E. Sch. as well as from the Euplectellids, *Saccocalyx pedunculates* F. E. Sch. and *Rhabdopectella tintinnus* O. Sch. The delicate and beautiful spirodiscohexaster (fig. 8) is of common occurrence in the subdermal region, but seems not to occur subgastrally. Diameter 95—120 μ. Center not particularly swollen; principals short, not more than 11.5 μ in the length of two opposite ones taken together, with capitulum scarcely or but little developed at the outer end. Each principal gives rise to 5—10 (usually 6—8), slender terminals which in the distal parts gradually thicken until they terminate each with a watchglass-like disc of about 7 μ diameter, fringed with 12—14, small marginal teeth. The terminals probably do not arise all in a whorl, but this point I could not make out with certainty. They form a lilyflower-like bunch, 50—56 μ long, about 11 μ broad at base and expanding distally to a width of about 38 μ. What at once calls one's attention is the fact that the bunch of terminals is spirally twisted in the basal third or fourth

of its length. The amount of twisting falls considerably short of a full circle; in lateral view of the parts a terminal is usually seen to be crossed 3—5 times in quick succession by its fellows. After carefully examining more than a dozen of the hexasters in question, I can say that the twisting is invariably sinistral.

A second kind of discohexasters is perhaps to be ascribed to the species. It consists of the different forms shown in figs. 9—12, — all the forms, being apparently gradationally connected by intermediate variations, are here put together under one kind. These hexasters were found occurring only sporadically in certain preparations, and not in all. Especially the fact that I searched after them in vain in sections of a well preserved piece of the sponge, makes me doubtful if they really belong to the species. The discohexaster in question is of variable size, and shows certain other points of variation in relation to the size. The smallest of the discohexasters (only 30—40 μ diameter, figs. 8 and 9 A) is nearly spherical, each short principal bearing 5 or 6 fine terminals which end with small discs provided with 5 or 6, minute, marginal teeth. Somewhat larger discohexasters (fig. 10) of the kind have less (usually 3 or 2) terminals to each principal and show terminal discs each made up of 5 or 4 claw-like prongs. Still larger and the largest ones, 75—85 μ in diameter, are either hemihexactinoid (fig. 11) or quite hexactinoid (fig. 12), each terminal ending as a rule with a whorl of only four recurved claws.

Genus **Tretopleura** n. g.

With the following single species.

1. *Tretopleura candelabrum*, n. sp. (Plate XXI, figs. 8—12; Plate XXII, figs. 1—4).

Stat. 226. 5° 26′.7 S., 127° 36′.5 E. 1595 m. Fragments.

Diagnosis. — Body form unknown, but large and with moderately thick, broadly expanding and more or less folded wall. Inhalent apertures on dermal surface of macerated skeleton relatively small (not over 1 mm. across), crowded but arranged in longitudinal linear series. Exhalent apertures on gastral surface large (1—2 mm. across) and separated by wider interspaces. Incurrent and excurrent canals vertically penetrating, apparently separated by dictyonal tissue. Dictyonal framework quite irregularly meshed, a part of the beams forming long and rather coarse, longitudinally running fibers; beams smooth except those lying superficially on the dermal side which are tubercled. Microhexactins with rough rays attached to dictyonal beams in abundance. Dermal spikes thickened to a thumb-like or a nearly ovoid shape, densely beset with tubercles. Gastral spikes more slender and less profusely tubercled, finger-like; standing out singly or in sets of 2—5 which represent as many rays of one and the same dictyonal hexactin, all pointing in the same direction, and together appear somewhat like the tines of a candelabrum. Covering spicules pinular hexactins (?). All other loose spicules unknown.

Description. — This new genus and species is based on several fragments, one of which is of considerable dimensions. They were obtained at Stat. 226, between Schildpad and Lucipara Islands in Banda Sea. Unfortunately all are dead and macerated specimens.

The largest fragment is the one shown in two views in pl. XXI, figs. 8 and 9. It had most of the interstices filled up by Foraminiferan shells, which had to be cleaned off by means

of acid in order to study the structure. It is a flat plate of a broadly tongue-like shape, 90 mm. long, 70 mm. broad, and about 5 mm. thick close to the rounded free end, but up to 8 mm. thick at the opposite, truncately broken off end. The broken off edge extends from the plate end, just indicated, contiguously into the lateral edges for a short distance on one side and for a longer distance on the other side. For the rest of the circumference the fragment has preserved the natural margin, which is round-edged. Close along the broken off parts of both lateral edges, the plate-like wall is bent towards one side which I take for the dermal (pl. XXI, fig. 9). The bending takes place roundedly but so that the planes of the wall parts on either side of the line of curvature stand almost at right angles to each other. It is difficult to make out from the fragments in hand what the general habitus of the entire sponge was like.

The two surfaces of the wall are of distinctly different appearances. In distinguishing between them the dermal and the gastral surface, I have chiefly relied on the fact that, in the dictyonine Hexactinellida generally, the spikes are more strongly developed on the dermal, than on the gastral, side of the wall. In the specimen under consideration, the surface which I assume to be the dermal on the basis of that distinctive character, is the one shown in pl. XXI, fig. 9. The opposite surface, i. e., that which in my opinion is the gastral, is shown in fig. 8, same Plate.

The dermal surface is distinguished by the crowded presence of apertures leading into pit-like inhalent canals, vertically disposed to the surface. The apertures are seldom quite, mostly distinctly less than, 1 mm. wide. They are more often of an angulated, rather than a roundish outline, and not infrequently somewhat elongate in the direction of the long axis of the specimen. In the original intact state of the specimen all these apertures were probably covered over by a continuous dermal lattice. The skeletal septa between the apertures and the canals they lead into are thin. The superficial interapertural dictyonal tissue presents to the naked eye a granulated-like appearance, which is due to remarkably thickly developed spikes of the surface. As to the arrangement of the apertures, one notices at once that these form longitudinal linear series, those in the median parts of the specimen running from the basal end of the specimen straight to the apex; but those more laterally situated on either side making a gentle curve towards the lateral margin of the respective side. In the longitudinal septa between every two linear series of inhalent canals runs a part of the long longitudinal fibers of the skeleton, which fact has evidently much to do in bringing about the said arrangement of the apertures and canals. Examined in a gross way, the inhalent canals appear to be not deeper than about onefourth the thickness of the wall (pl. XXII, fig. 1). By looking into them from the outside there can be discerned at their bottom some strands of the longitudinal dictyonal fibers passing across.

The gastral surface (pl. XXI, fig. 8) differs from the dermal in exhibiting larger canal apertures which are separated from one another by very much wider interspaces. The apertures in the marginal parts of the surface are roundish, relatively small (about 1 mm. diameter) and rather crowded. In the middle parts the larger apertures may measure up to 2 mm. across; and are frequently of an oval or oblong shape, attaining 3 mm. or over in length. Within all the larger apertures there can be plainly observed from the outside two or more smaller secondary openings, and again within these still smaller tertiary openings, in manifestation

of the primary canals undergoing successive branching in the thickness of the wall. The visibility of this feature of canals through their external apertures is characteristic of exhalent canals in the Hexactinellida generally; and here, I believe, is another indication that the canals in question of the specimen are exhalent and the surface on which they open is the gastral. The interapertural spaces are at places nearly 2 mm. wide, presenting a moderately even surface of a pith-like texture. Under the lens they appear slightly hispid on account of the crowded spine-like spikes of this side.

In longitudinal sections of the wall (pl. XXII, fig. 1), one may easily observe in the deep parts of the dictyonal framework the existence of an ill-defined layer in which the thicker beam fibers (up to 110 μ thick) run in the main longitudinally. A small part of the layer is shown, moderately magnified, in pl. XXII, fig. 4. Reference to a part of this system of longitudinal fibers has already been made in connection with the inhalent canals. The main part of the system extends in a nearly continuous layer nearer to the dermal than to the gastral surface, as will be seen from pl. XXII, fig. 1. In relation to that fact, the exhalent canals penetrate to a longer distance into the wall than the inhalent, that is, so far as the broad and easily recognizable parts of both canals go. Probably the ultimate branches of both the canal systems penetrate much more deeply than is apparent from observations on the skeleton. However, a wide and free communication between the two canal systems do not exist, but there seems to intervene always a septal partition of close-meshed dictyonal tissue between them. Of this fact I have fairly well convinced myself by repeated examinations of the sponge from the exterior as well as of sections cut in various directions. After all I believe that the diarhysis, which I regard to be peculiar to the Tretodictyidae, is here non-existent.

The dictyonal framework consists of beams varying in thickness from 50 μ to 110 μ. They are perfectly smooth on surface, except those most superficially situated on the dermal surface which may show a greater or less amount of tuberculation in continuation of that of the spikes (pl. XXI, fig. 12; pl. XXII, fig. 2). The beams in part form long fibers. Most of the fibers which are most strongly developed constitute the longitudinal system before mentioned; many branch out from that system and proceed into the septa between canals (pl. XXII, fig. 1). The meshes formed by the fibers and shorter beams are variously shaped. The nearly parallel running longitudinal fibers may at places be connected by a series of transverse beams after the manner of a ladder; at other places they are irregularly connected. The meshwork in the septa is irregular throughout.

Remarkable is the abundant occurrence, in all parts of the skeleton, of regular rough-rayed microhexactins attached by one of the rays to dictyonal fibers and other beams (pl. XXII, figs. 2—4). They are mostly under 175 μ in axial length. Not infrequently a microhexactin, attached in the way mentioned, may bear in its turn another of its kind, or even several more in succession, but without definiteness in their relative orientation. Occasionally the microhexactin has unusually thickened rays, approaching in appearance the constituent hexactins of the dictyonal framework. It may without doubt be regarded as the representative of the fundamental structural elements of the entire dictyonal skeleton.

The spikes require special consideration. Those of the dermal surface are unusually stoutly — often excessively — developed (pl. XXII, fig. 2), being generally of a thickly thumb-

like or nearly ovoidal shape, up to 200 μ wide by 385 μ long. They are commonly not quite symmetrical, but rather irregular in outline, with rounded or subtruncate apex. On surface they are densely studded with large and small tubercles which are in part conical and in part rounded. Sometimes two or three spikes arise from a common node (pl. XXI, figs. 12), as most gastral spikes.

The gastral spikes (pl. XXII, fig. 3) are generally relatively slender and finger-like, with tuberculation on surface which is not very dense. They spring out from superficially situated spicular centers of the dictyonal skeleton sometimes singly but more commonly in sets of 2—5 together. In the latter case some of the spikes in the same set may be so bent that they all point in the same direction, somewhat like the tires in a candelabrum. It is manifest that the several spikes in a set are so many free rays of a hexactin which with the remaining rays stand in connection with the dictyonal skeleton. There can scarcely be a doubt that the hexactin arose by growth from a microhexactin, such as is actually found attached to dictyonal beams in all parts of the skeleton. In the older parts of the specimen the gastral spikes are occasionally found irregularly thickened and rather densely tubercled, much in the same way as those which are seen in pl. XXI, fig. 12. The above candelabrum-like arrangement of gastral spikes seems to constitute a feature peculiar to the species, and so far as I am aware, not known in any other Hexactinellid species.

Of the loose spicules of the species I have nothing certain to report. A case or two of a pinular hexactin, securely caught in among the dictyonal reticulum near the gastral surface, were met with. The slightly swollen and short-spiny pinular ray was of a stunted-like appearance, measuring only 55 μ in length; other rays were smooth but rough at end, the paratangentials being 130 μ and the proximal ray 200 μ long. Of course it cannot be definitely given if the spicule really belonged to the specimen.

From among the smaller fragments of the species obtained at the same station, I have selected for description the one shown in pl. XXI, figs. 10 and 11. It is in one part fully 10 mm. thick. Both dermal and gastral surfaces show canal apertures which are more crowded, besides being considerably larger, than in the specimen described above. The inhalent apertures (fig. 10), up to nearly 1.5 mm. in width, are arranged in indistinct longitudinal rows. The exhalent apertures (fig. 11) reach 3 mm. in width and lead into canals which are deeper than those connected with the inhalent apertures. Dermal and gastral spikes could not be observed, probably owing, in part at least, to mutilation of the surfaces; but on the wall of some canals — both inhalent and exhalent — I have found some rough and thickened spikes in characteristic little groups looking much like those to be seen in pl. XXI, fig. 12. In the middle of the thickness of the wall there exists a zone of coarse longitudinal fibers, which, together with connecting cross-beams, being about meshes of an elongate shape. Noteworthy is the dearth of microhexactins in the present fragment. Likewise the fact that dictyonal beams are weakly rough in all parts of it. I think the fragment under consideration represents a more basal part of an individual than the first described; and what differences there exist between the two in the characters of skeleton may be largely due to that circumstance, be the fragments from one and the same individual or not.

Family Aphrocallistidae J. E. Gray, 1867.

Melittionidae Zittel, 1877, p. 36. — F. E. Sch., 1886, p. 73; 1887, pp. 304, 395; 1902, p. 87.
Aphrocallistidae J. E. Gray, 1867. — F. E. Sch., 1904, p. 179. — Schram., 1910—12, p. 218.
Coscinoporidae partim, F. E. Schulze, 1886, p. 76; 1887, pp. 326, 396; 1904, p. 178.
Chonelasmatidae partim, Schrammen, 1910—12., p. 190.

Scopularia with closely set diarhyses. Interdiarhytic skeletal framework irregular-meshed and made up of hexactins which are either all of about the normal development or in part so laterally compressed and flattened by the bending of certain rays, that all the six belonging to one and the same spicule may lie in nearly the plane of the skeletal septum it belongs to. Scopule always present.

Besides *Aphrocallistes* Gray, I include in this family the new genus *Heterochone* which I have instituted for a part of F. E. Schulze's *Chonelasma*, taking for genotype *H. calyx* (= *Chonelasma calyx* F. E. Sch., 1886). A second species referable to *Heterochone* is *C. tenerum* F. E. S. (1899*a*). *C. hamatum* F. E. S. (1886) is possibly also a *Heterochone*.

The Aphrocallistids are generally vasiform or branched-tubular sponges with blind or osculated outbulgings on the sides. If it be really correct to refer *Chonelasma hamatum* to *Heterochone*, then it appears that the habitus may even be plate-like.

In *Aphrocallistes* the diarhyses are, as is well known, regularly six-sided in cross-section, so that the skeleton looks exquisitely like a honeycomb. They are open at both their external and internal ends except for being covered over by the dermal or the gastral layers, as the case may be. The condition is somewhat different in *Heterochone*. Here the canals, as known to me from original studies on *H. calyx*, are of an irregular shape in cross-section. In the young growing parts of the sponge they are, exactly as in *Aphrocallistes*, open at both their ends, that is, when thought of as deprived of the superficial covering layer. With respect to the external apertures, the open state persists throughout life and in all parts of the sponge exterior. Whereas, the internal apertures in the older parts of the body become partially closed, so to say, by the development of a thin and cobweb-like subgastral dictyonal layer. But this closure, as I judge it, is only nominal, signifying no more than a relatively less clearly open state of certain canal ends in comparison with some others. The real fact is, there exist apertural gaps of very various widths in the gastral layer supported by the subgastral dictyonal cobweb, and those canal ends which happen to confront the larger gaps appear clearly open, while others, over which the gaps are small, are more or less obstructed in the passage into the gastral cavity on account of the subgastral beams. Thus, I see no essential difference between *H. calyx* and *Aphrocallistes* in the nature of their canal system, except in the canals of the former being occasionally apparently, though not really, "closed" at the inner end.

In *Heterochone* the dictyonal reticulum is, in the peripheral parts of interdiarhytic septa, dense and irregularly small-meshed, appearing much the same as of certain Euretids. In the deeper parts the reticulum is of a much looser appearance, owing to the generally larger size

of meshes and to the frequent existence of such relatively wide and irregular spaces as seem to represent several contiguous meshes which are incompletely divided in consequence of some rays from adjacent dictyonal hexactins ending free instead of reaching and joining beams from other dictyonal hexactins. Of such freely ending, spine-like rays there are many, standing out more than one at a time from the centre of hexactins, other rays of which form complete sides to meshes and are often so joined together as to form linear fibres of great length. Of quite a markedly different appearance is the skeletal septum of the more firmly built *Aphrocallistes*. Here the meshes are generally all small and completely bounded. It may be in some parts, somewhat as in Euretids, containing triangular or irregularly quadrangular meshes. In other parts more or less like an irregularly cribriform plate pierced by holes which are open and of an irregular but often oval or roundish shape. As examination of axial canals shows, the plate frequently contains among its reticulating beams all the six rays of the hexactin, a state of things brought about by the bending of many of those rays which otherwise should stand out freely from the plane of the septum and by the joining of such rays in the formation of the reticulating beams. The six rays, after their origin from the common centre, run in various directions in the septum. It is not difficult to imagine that the above condition of septum, highly peculiar as it is, was derived from that ssen in *Heterochone* as a result of that cause which also accounts for the regularly hexazonal cross-section of the canals in the genus under question, *viz.*, the securing of the widest possible lumen to each of the canals under mutual restraining influences and the consequent compression brought to bear on the septal partition.

The dermalia are commonly hexactins with pinular or pinular-like distal ray. Sometimes, however, that ray may be more or less atrophied, being represented by a peg-like rudiment or even by a mere knob, in which latter case the spicule may be called a pentactin. The gastralia in *Heterochone* are similar to the dermalia; but in *Aphrocallistes* they are generally rhabdodiactins. Hexasters are either oxyhexasters or discohexasters, or both. The scopule and the uncinate are always present. Hexaster in the form of oxyhexaster, onychohexaster, tylohexaster or discohexaster, any of which forms, instead of being always regular ("synotigme" form) may sometimes have one or two principals in one axis elongated over the others ("syngramme" form of hexaster); principals, especially those arising at right angles from the long axis of elongated hexasters, may frequently be uniterminal (hemihexaster).

Here it may as well be noted that canals, which are possibly to be regarded as diarhyses, seem to exist in the fossil *Syringium textum*, a form described by SCHRAMMEN (1910—12, p. 256) from the Upper Cretaceous and which was made by him the basis of a special family, the Syringidae. The radial canals traversing the thin wall of the tubular sponge, were given by the describer as being in part open at both ends and in part closed externally though open internally. I cannot entirely suppress the presumption that we have here to deal with a condition of diarhyses akin to that we have seen in *Heterochone*, but with this difference that the nominal closure of certain canals is on the external end instead of the internal, due to circumstances of the development of the covering dictyonal layer ("Deckschicht"), said to be present on the dermal side only.

Containing the single genus, *Aphrocallistes* Gray, with characters of the family.

Genus **Aphrocallistes** J. E. Gray, 1858.

Aphrocallistes J. E. Gray, 1858, p. 114. — F. E. Schulze, 1887, pp. 305, 310, 395. — Ditto, 1904, pp. 144, 148.
Iphiton partium, J. S. Bowerbank, 1869, p. 325.

The genus, as at present known, comprises two surely known living species, viz.:

1. *Aphrocallistes beatrix* Gray, 1858, Pacific, Indian and Atlantic oceans.
2. *Aphrocallistes vastus* F. E. Sch., 1886 (? incl. *A. whiteavesianus* Lambe, 1892). Japan and W. coast of N. America.

The Siboga has obtained, at no less than sixteen of her stations, numerous specimens of *Aphrocallistes*, all of which may safely be referred to the exceedingly variable species. *A. beatrix*.

1. *Aphrocallistes beatrix* J. E. Gray, 1858. (Plate XXIV, figs. 20—30; Plate XXV. Textfig. 35).

Aphrocallistes beatrix J. E. Gray, 1858, p. 114; pl. XI. — Ditto, 1867, p. 507. — C. W. Thomson, 1868, p. 119. — H. J. Carter, 1873, pp. 359, 451, figs. in pls. XIII and XV. — F. E. Schulze, 1886, p. 75. — Ditto, 1887, p. 311; pl. LXXXIV, figs. 9, 10. — Ditto, 1896, p. 68; pl. VII, figs. 1—13. — Ditto, 1900(*a*), p. 38. — Ditto, 1902, p. 87; pl. XV, figs. 1—13. — Ditto, 1904, pp. 39, 147; pl. XI—XIII, pl. XIV, figs. 1—6. — J. Stephens, 1915, p. 5.
Iphiteon beatrix J. S. Bowerbank, 1869, p. 325; pl. XXI, figs. 2—4 and pl. XXII, figs. 2—9.
Aphrocallistes bocagei E. P. Wright, 1870, p. 4; pl. I. — W. S. Kent, 1870, p. 248; pl. LXV, figs. 8—15. — O. Schmidt, 1870, p. 17; pl. II, figs. 1, 11, 12. — H. J. Carter, 1873, pp. 359, 450; figs. in pls. XIII and XV. — F. E. Schulze, 1886, p. 74. — Ditto, 1887, p. 313; pl. LXXXIII, pl. LXXXIV, figs. 1—8. — R. Kirkpatrick, 1889, p. 446. — E. Topsent, 1892, p. 32. — F. E. Schulze, 1896, p. 78; pl. VIII, figs. 1—11. — Ditto, 1899(*a*), pp. 95, 110. — Ditto, 1900(*a*), p. 39. — Ditto, 1902, p. 93; pl. XVI. — E. Topsent, 1904(*b*), p. 48.
Aphrocallistes sp., O. Schmidt, 1880, p. 48; pl. VII, figs. 5A—F.
Aphrocallistes ramosus F. E. Schulze, 1886, p. 75. — Ditto, 1887, p. 319; pl. LXXXVI. — Ditto, 1896, p. 76; pl. VII, fig. 14. — Ditto, 1902, p. 97, pl. XV, fig. 14.
? *Aphrocallistes azoricus* E. Topsent, 1901(*b*), p. 455. — Ditto, 1904(*b*), p. 48; pl. V, figs. 7, 8; pl. VII, fig. 1.
Aphrocallistes beatrix orientalis Ijima, 1916, p. 173.

List of Siboga Stations at which the species was obtained.

Stat. 12. 7° 15′ S., 115° 15′.6 E. 289 m. 1 incompl. specimen and fragments.
Stat. 95. 5° 43′.5 N., 119° 40′ E. 522 m. Small fragments.
Stat. 105. 6° 8′ N., 121° 19′ E. 275 m. Small fragments.
Stat. 145. 0° 54′ S., 128° 39′.9 E. 827 m. Some fragments.
Stat. 159. 0° 59′.1 S., 129° 48′.8 E. 411 m. Some fragments.
Stat. 177. 2° 24′.5 S., 129° 38′.5 E. 1633 m. 2 incompl. specimens.
Stat. 226. 5° 26′.7 S., 127° 36′.5 E. 1595 m. Numerous small fragments.
Stat. 251. 5° 28′.4 S., 132° 0′.2 E. 204 m. 1 incomplete specimen and fragments.
Stat. 254. 5° 40′ S., 132° 26′ E. 310 m. Some fragments.
Stat. 256. 5° 26′.6 S., 132° 32′.5 E. 397 m. 1 incomplete specimen and a fragment.
Stat. 262. 5° 53′.8 S., 132° 48′.8 E. 560 m. 1 incomplete specimen.
Stat. 266. 5° 56′.5 S., 132° 47′.7 E. 595 m. 1 incomplete specimen.
Stat. 267. 5° 54′ S., 132° 56′.7 E. 984 m. Some fragmentary specimens.
Stat. 280. 8° 17′.4 S., 127° 30′.7 E. 1224 m. Small fragments.
Stat. 300. 10° 48′.6 S., 123° 23′.1 E. 918 m. 1 small fragment.
Stat. 312. 8° 19′ S., 117° 41′ E. 274 m. Numerous fragmentary specimens.

Diagnosis. — *Aphrocallistes* tubular and branching, or deeply calyx-like with radial tubular outbulgings and with the opening at the upperend closed by a sieve-plate. Hexaster of varying characters (oxy-, tylo-, onycho- or disco-hexaster); frequently hemihexasterous with one principal or two opposite principals more elongated than the others [1]).

Description. — The Stations, at which the Siboga obtained specimens of *Aphrocallistes beatrix*, are distributed in the following seas:

1. Bali Sea (Stations 12, 312).
2. Banda Sea (Stations 226, 251).
3. Kei Islands (Stations 254, 256, 262, 266, 267).
4. Timor Sea (Stations 280, 300).
5. Ceram Sea (Station 177).
6. Halmaheira Sea (Stations 145, 159).
7. Sulu Sea (Stations 95, 105).

1. Bali Sea:

Stat. 12 (S. of Kangeang I.; 289 m.) pl. XXIV, figs. 20—30; pl. XXV, figs. 1—3. — From this locality there are an incomplete stock and some dead fragments. The former consists of branching and anastomosing tubes, which in most parts measure 6—10 mm. in diameter and not over 1 mm. in the thickness of wall. Some of the latter are tubular and fully reach up to 15 mm. in diameter, and 2 mm. in the thickness of wall. The structure and spicules of these specimens are illustrated in pl. XXIV, figs. 20—30 and pl. XXV, figs. 1—3.

The radial canals of the skeleton are mostly 600—900 μ or slightly over in width. They present a regularly hexagonal outline in cross-section (pl. XXV, fig. 1). The skeletal septa, seen lateral surface on, between the lines of their junction with one another (pl. XXIV, fig. 20), are for the most of a thinly flattened appearance, the beams and nodes being arranged in a single layer. None of the nodes are swollen in a knot-like way. The tuberculation of the reticulum is fine, decidedly sparse and quite unevenly distributed. Rough spikes stand out erect on the dermal edge of septa; those on the lateral surface of same are directed obliquely towards the outer end of the canal, while those on the gastral edge are frequently more or less prolonged into a whip-like shape (up to about 1 mm. long) and are all so inclined or bent as to point with their ends towards the oscular end of the tubular body. In all these respects the septal skeleton closely resembles F. E. Schulze's figure (1904, pl. XI, fig. 2) of same, drawn from a specimen obtained by the "Valdivia" in Siberut Strait on the S.W. coast of Sumatra. On the other hand, it differs notably from that of the Japanese specimens (*Aphr. beatrix orientalis* Ij.) which have the reticulum by no means so evenly flattened out, and apparently in a still greater degree from that of the type of the species, the Malacca specimen first described by Gray, in which the septal skeleton, as judged especially from the excellent figures given by Bowerbank (1869), are apparently of the nature of a three-dimensional reticulum of some thickness, with triangular meshes and many of the multiradiate nodes distinctly swollen into a berry-like knot.

1) In distinction from this, *Aphrocallistes vastus* F. E. Sch. may be diagnosed thus: *Aphrocallistes* large, calyx-like, open above, with broad and flat outbulgings of wall. Hexaster nearly exclusively regular discohexaster or tylohexaster, only exceptionally hemihexasterous and with one or two opposite principals more elongated than the others.

In the choanosome there is an occasional occurrence of free regular oxyhexactins with slender, obsoletely rough rays, about 116 μ long.

The dermalia are predominantly hexactins with pinularly developed distal ray (pl. XXIV, fig. 21). Tangential rays 115—162 μ long; proximal ray about as long or somewhat shorter. The pinular ray, is slenderly poplar-tree-like, measuring usually. 116—255 μ long (mostly 175—220 μ, and on an average about 200 μ), it is bare in the basal parts, but more distally begins to bear short spines and acquires in the distal half of its length an exquisitely plumose appearance, due to the increased presence of lateral spines up to 35 μ long. The plumose parts may measure about 30 μ in greatest breadth. Only occasionally the pinular ray is rudimentarily developed or may even be reduced to a mere knob. In general the ray in question differs very considerably in appearance from that figured by F. E. SCHULZE (1896, pl. VII, fig. 4) from a Bay of Bengal specimen of *Aphr. beatrix*, in being of a much more slenderly club-like (instead of spindle-like) outline and in the spines being much weaker though more numerous in number. Somewhat closer is its resemblance to that which the same author has depicted in the Challenger Report, pl. LXXXIV, fig. 8, from an Atlantic specimen of "*Aphr. bocagei*"; but the agreement cannot be said to be perfect. As regards the pinular hexactine dermalia of GRAY's original type (from Malacca) of *Aphr. beatrix*, and also of the specimens collected by the "Valdivia", the representations by authors are unfortunately not sufficiently clear to be of use here for comparison. The dermalia of *Aphr. beatrix orientalis* Ij. consist largely of pentactins, with an admixture, in variable proportions, of hexactins in which the distal ray may be spineless and simply peg-like, or spined and subplumose, but is rarely quite plumose, the length generally standing very considerably under 185 μ (IJIMA, 1916, p. 176).

The scopules are of two kinds, the pachyscopule and the leptoscopule. The former (pl. XXV, fig. 3) is rare. In appearance it compares fairly well with the same of *Aphr. beatrix orientalis* as well as with the figure of same given by F. E. SCHULZE (1896, pl. VII, fig. 5) from a Bay of Bengal specimen of "*Aphr. bocagei*". The same scopule evidently occurs also in GRAY's type specimen from Malacca, as attested to by a figure given by CARTER (1873, pl. XV, fig. 2) from that specimen. The slim leptoscopule (pl. XXV, fig. 2), with outwardly flexed terminal branches, is of a far more common occurrence. It is generally 348 μ long. As a point of notable difference from the corresponding scopule of *Aphr. beatrix orientalis* may be mentioned the fact that, whereas in that form the terminal swelling of the branches is a relatively small bulb beset with small barbs, the same in the Siboga specimens is larger and more disc-like, terminating with a watchglass-like convex surface surrounded by two circles of recurved teeth. The terminal disc measures 12 μ across, the teeth inclusive. The appearance of the swelling is more similar to that represented by CARTER (1873, pl. XV, fig. 1) from a Portuguese specimen of "*Aphr. bocagei*" or by F. E. SCHULZE (1896, pl. VII, fig. 2; pl. VIII, fig. 4) from *Aphr. beatrix* and "*Aphr. bocagei*", obtained by the "Investigator" in the Bay of Bengal. From GRAY's type (from Malacca) of the species, the same swelling is known only as a little knob, and was figured as such by both THOMSON (1868, p. 123) and BOWERBANK (1869).

The hexasters are very rarely discohexasters and much more commonly oxyhexasters. The discohexaster was discovered only after a prolonged search. It is either regular (pl. XXIV,

fig. 22), measuring 50—70 μ in diameter, or elongate in the usual way. The fine claws at the end of slender terminals appear much like those in an onychaster, but with this difference that they arise from a very minute, disc-like, central swelling. I am inclined to think that we have here to do with a discohexaster form which approaches the genuine onychaster, such as has been reported by F. E. SCHULZE from the Indian Ocean specimens.

In many preparations the oxyhexasters were the only kind of rosettes to be found. When regularly developed, as it not infrequently is, the oxyhexaster (50—70 μ in diameter) appears much like the above regular discohexaster, except of course in the manner of termination of the rays. It is also quite like the regular oxyhexaster met with in *Aphr. beatrix orientalis* of the Japanese coast. It occurs about as frequently in the form of elongate hemi-oxyhexasters. These were common in some parts of the sponge, but totally undiscoverable in certain preparations. They are very variable in size and in the development of parts. While the smaller elongate hemi-oxyhexaster, such as the one shown in pl. XXIV, fig. 24, is not much longer than the diameter of an average-sized regular oxyhexaster and shows terminals about equally fine as those of the latters, the larger ones (pl. XXIV, figs. 25—27) frequently measure over 100 μ, reaching up to 150 μ, in total length, the axial shaft and the rays greatly gaining in strength at the same time. The shaft may reach 50 μ in length and 5 μ in thickness. The most usual form of the hemi-oxyhexaster is that in which only one of the six principals is, instead of being quite or nearly atrophied, distinctly prolonged to form the major part or practically nearly the entire length of the axial shaft with 2—5 terminals at each end, and in which the central node, situated close to one shaft end, bears a whorl of four simple lateral spines in cruciate arrangement, i. e., four single terminals corresponding to as many atrophied principals at right angles to the shaft axis. In a single case of the hexaster I have observed two of the lateral spines taking each the form of a short principal which forked into two divergent terminals, there being thus two uniterminal and two biterminal principals, standing out at right angles to one another as well as to the axis of the two remaining, unequally long principals that go to form the shaft. Pl. XXIV, figs. 28—30 show rare and exceptional variations of the elongate hemi-oxyhexaster; fig. 28, a case in which two lateral spines persist as very short processes, while the remaining two are outwardly entirely suppressed; fig. 29, another case in which the abortive principal in the same axis as the prolonged principal is uniterminal, like the four at right angles to that axis; and fig. 30, still another case in which the prolonged principal is uniterminal and the opposite atrophied principal is represented by two divergent terminals that evidently belonged to it, while of the four lateral spines there remains only a single one unsuppressed. — The large and strong development of the elongate hemi-oxyhexaster to the extent indicated above (figs. 25—27), has never yet been observed in *Aphr. beatrix orientalis* of the Japanese coast, in which form the hexaster but seldom approaches 100 μ in length and remains much weaker in the development of both shaft and rays (generally only about half as long in total length, with proportionately thin part, as in the Bali Sea specimens under consideration). As regards GRAY's type of the species, it may be assumed, especially from the figures given alike by THOMSON (1868, p. 123), BOWERBANK (1869, pl. XXI, fig. 3 and pl. XXII, fig. 4) and CARTER (1873, pl. XIII, figs. 19, 20), that it agrees fairly well with the Bali Sea specimen in the development of the elongate hemi-oxyhexaster. The same may probably be said for the Bay of Bengal specimens of *Aphrocallistes*

collected by the "Investigator", as the figures given by F. E. Schulze (1896, pls. VII, VIII) indicate. Lateral spine or spines to the shaft of the elongate hemi-oxyhexaster, other than those which arise from the central node and to be unmistakeably interpreted as terminals of suppressed principals, were figured by Bowerbank (1869, pl. XX, fig. 4), Carter (1873, pl. XIII, fig. 20) and Schulze (1887, pl. LXXXIV, fig. 10) from the type (Gray's Malacca specimen) of the species and subsequently again by Schulze (1896, pl. VII, fig. 7) from a Bay of Bengal specimen obtained by the "Investigator". They are probably of only casual occurrence.

It is at present scarcely possible to exactly determine the subspecific or varietal status of the above described specimens from Stat. 12 within the wide range of *Aphr. beatrix*. However, so far seems tolerably certain that they cannot well be taken up into *Aph. beatrix orientalis*. That goes from collectively taking into consideration the differences already pointed out in relation to the structure of the septal dictyonal skeleton and to the development of the dermalia, the lepto-scopule and the elongate hemi-oxyhexaster. The specimens may sooner be classed together with those known from Indian and Atlantic Oceans in which the dermalia are hexactins with well developed pinular ray; but perhaps especially with those from the south-western coast of Sumatra which were figured by F. E. Schulze in the "Valdivia" Report.

Stat. 312 (Bali Sea, or more exactly entrance to Saleh Bay, Sumbawa I.; 274 m.). Pl. XXV, fig. 12—17.

At this Station was obtained a large number — say, about two handfuls — of fragmentary specimens which probably originated from more than one stock. Pl. XXV, fig. 12 shows the largest specimen in the lot. All the pieces are tubular and of a more or less ramose habitus, the tubes being generally 5—9 mm. in diameter and not over 0.8 mm. in the thickness of wall. None of the specimens are of a vasiform shape. The honeycomb-like apertures of radial canals are generally 670—835 μ and occasionally nearly 1 mm. or even over in width. They are appreciably less regularly hexagonal than in the last described specimens from Stat. 12 (pl. XXV, fig. 1) or in certain specimens to be later described from Kei Islands (pl. XXV, fig. 4), Ceram Sea (pl. XXV, fig. 5), Banda Sea, Timor Sea and Halmaheira Sea. In general macroscopic appearance and in dimensions of parts the specimens now under consideration may be said to be in fair agreement with *Aphr. beatrix orientalis* of the Japanese coast. This holds good also for the spiculation.

The dictyonal skeleton of canal septa is sometimes thinly flattened, somewhat as in the specimens from Stat. 12; more generally it is of an irregular thickness throughout, in that the constituent beams and nodes do not all lie in a plane, but form a reticulum which frequently show in its thickness some nodes lying below or above the level of others (pl. XXV, fig. 17). This agrees with the condition observable in the Japanese specimens and may stand in relation to the radial canals being of a relatively small width. The figures given by Bowerbank of the septal skeleton in Gray's type of the species lead one to think that somewhat the same condition obtains in that specimen. The dictyonal beams are very sparsely tubercled; at places they may be said to be quite or nearly smooth. Free parenchymal oxyhexactins with thin rough rays of usually 100—120 μ length are rather abundantly present.

The dermalia are sparsely preserved in the specimens. The commonest form of them was found to be as in *Aphr. beatrix orientalis*, not hexactine pinules, but rough-rayed pentactins

in which the atrophied distal ray was represented by a knob. In only a few cases that ray was prolonged and short-spiny, thus converting the spicule into a hexactin with short and ill-developed pinular distal ray. Tangentials ordinarily 100—230 μ long; proximal ray about as long or somewhat shorter. Unusually strongly developed dermal pentactins may measure 350 μ in the length of rays. The gastralia and uncinates are as usual without important characterization.

The scopules are of the usual two kinds. The leptoscopule (pl. XXV, fig. 14) is very common; it measures 324—394 μ in total length, with 70—88 μ long terminal branches, of which there are usually four at a time, each ending with a small (not over 6 μ across) bulbous swelling beset with two or three irregular whorls of small barbs. The pachyscopule (pl. XXV, fig. 13) occurs much more sparsely; it is 394—500 μ long, with terminal branches of 50—70 μ length. Both the kinds compare well in appearance with the same in *Aphr. beatrix orientalis.*

Of the hexaster, I have found only elongate discohexasters (pl. XXV, figs. 15, 16) of much the same small size and appearance as those of the Japanese form. They are of common occurrence, measuring 52—80 μ in length, the shaft being 20—28 μ long. The spicular center usually lies close to one end of shaft, rarely at the middle. The hexaster seems never to reach the size attained by same in the specimens from Stat. 12. Not a single oxyhexaster was discovered.

In consideration of so many points of nearly perfect agreement with *Aphr. beatrix orientalis*, I feel no hesitancy in referring the above specimens from Bali Sea to that form.

2. Banda Sea:

Stat. 226 (between Schildpad and Lucipara Islands; 1595 m.). — The lot of *Aphr. beatrix* from this spot consists of numerous small fragments, all dead and without loose spicules.

From their shape and curvature it may be inferred that they originally formed parts of a stock which consisted of rather wide tubes. The wall is commonly 1—2 mm., at some places even fully 3 mm., thick. The radial canals, generally 0.8—1.2 mm. wide, are pretty regularly hexagonal in cross-sections, being separated from one another by rather thin and evenly flattened septal reticulum made up of sparsely and irregularly tubercled dictyonal beams. From the far-going agreement in general appearance and dimensions of the skeleton, it seems justifiable to assume that we have here to do with probably the same form of *Aphr. beatrix* as that which the Siboga obtained at her Stat. 12 in Bali Sea.

Stat. 251 (S. of Kur I., near Kei Is.; 204 m.). — From this locality there is, besides some small fragments, the incomplete, irregularly branching, tubular specimen shown in pl. XXV, fig. 4. All are entirely destitute of loose spicules. The specimen figured is distinctly laterally compressed in the broadest parts, where the diameter measures 19 mm. in one way and 13 mm. in another. The wall is 1—2 mm. thick. The radial canals are up to 1 mm. in width and pretty regularly hexagonal in sectional outline. Here is, in all appearance, still another specimen which may be assumed to belong to the same form of *Aphr. beatrix* as those from Stat. 12. At any rate, it cannot well be received into the rank of *Aphr. beatrix orientalis.*

3. Kei Islands:

Stat. 256 (397 m.). — The fragmentary specimen (pl. XXV, fig. 18) obtained at this Station apparently represents the upper parts of a ramose stock. The tubular body, 6—10 mm. in diameter, is divided above into a number of short terminal branches, each with an osculum

at the end. The wall is nearly, but not quite, 1 mm. thick. The honeycomb-like canal meshes are 0.5—1 mm. wide; they are not so regularly and uniformly hexagonal as in the specimens from Stat. 12. It may here at once be given that the specimen is so much like the form *orientalis* in macroscopic respects as well as in essential points of finer structure and spiculation that it may well be regarded to belong to that form, together with the specimens already described from Stat. 312 in Bali Sea.

As in the specimens just referred to, the septal skeleton is made up of beams and nodes not all in a plane but forming a relatively small-meshed reticulum of irregular thickness (pl. XXV, fig. 19). The tubercles on the beams are rather strongly developed, conical in shape, and numerous though in irregular distribution. Rough or spinulose parenchymal oxyhexactins with rays 100—175 μ long occur very abundantly in some parts.

The dermalia (pl. XXV, fig. 23) are in part pinular hexactins and in part pentactins with a swelling in place of the suppressed distal ray (same figure, *d*). Tangential rays 80—200 μ long and usually about 7 μ thick at base; proximal ray about as long or somewhat shorter. The pinular ray of the hexactins (*a*—*c*) is slender, up to 190 μ but usually 140 μ long and sometimes still shorter and more or less rudimentary in development; the lateral spines are best developed in the distal third of the ray, are never very long, and give to the parts a breadth of 20 μ and less. Occasionally, pentactine dermalia show exceptionally robust development (pl. XXV, fig. 22), the rays attaining a thickness of nearly 20 μ at base by a length of about 200 μ and with densely tuberculated surface. It seems that such robust pentactine dermalia are confined in their occurrence to the central parts of dermal areas over the external entrance into radial canals. The occurrence of similar pentactins in the same position was observed by me also in certain specimens of *Aphr. beatrix orientalis* from the Japanese coast.

The gastralia are spinulose diactins, generally without central annular or knob-like swellings. While a short gastralial spicule is only 350 μ long, a long one may be nearly filamentous, reaching up to 1.5 mm. in length with a thickness of 16 μ in the middle.

Of common occurrence is the leptoscopule (pl. XXV, fig. 21) of fairly the same appearance and development as that of the specimens from Stat. 312. Total length 315—460 μ; the branches 4 or 5 in number, 72—100 μ long, and perceptibly bent outwards; the terminal swelling of branches bulbous, small (not over 8 μ across), showing retroverted spinules in two or three circles.

The pachyscopule is very robustly developed (pl. XXV, fig. 20). Total length 600—660 μ; the branches usually four and seldom more in number, 100—110 μ long, as thick as 12 μ in the basal parts, ending simply rounded at tip. In an early developmental stage of this spicule, the branches taper out to a fine point.

The uncinates are without important characterizations.

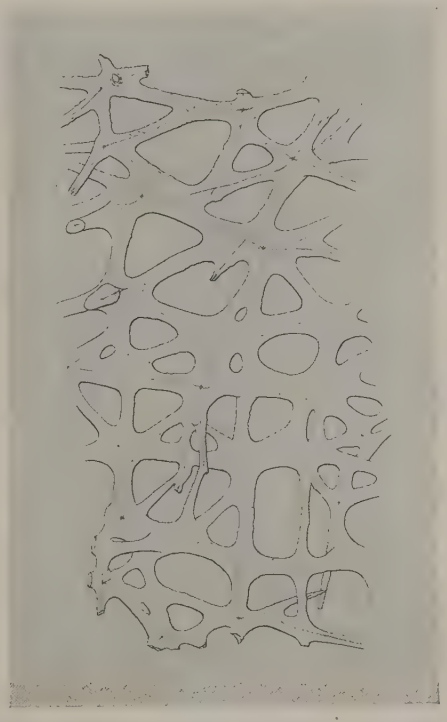
The hexasters are remarkably scarce. The few of them discovered after laborious searches were all small discohexasters with very minute terminal discs, in both regular and elongate forms. The former form (pl. XXV, fig. 24) of hexaster measured about 52 μ in diameter, each principal bearing four or five delicate terminals. The latter form (pl. XXV, fig. 25) was 92 μ long, with axial shaft 40 μ long and tapering terminals up to 30 μ long.

Stations 254, 262, 266, 267 (all among Kei Islands; 310—984 m.) — The specimens from these Stations are all macerated tubular fragments, scarcely worth while to describe in detail. Suffice it to say that they not improbably represent the same form (*orientalis*) of *Aphr. beatrix* as the last described specimen from Stat. 256, a spot likewise in the region of Kei Islands.

4. Timor Sea:

Stat. 280 (off E. end of Timor; 1224 m.) and Stat. 300 (S. of Rotti I. at the S.W. end of Timor; 918 m.).

At these two stations were obtained some small and completely washed-out fragments, from which the habitus of the original stock cannot be ascertained. The wall is relatively thick, measuring from about 1.3 mm. to fully 2 mm. in thickness. Radial canals 0.75—1 mm. or over in width; septa thin, flat, and made up of sparsely and insignificantly tubercled beams (textfig. 35) [1]).



Textfig. 35. — Septal skeleton of *Aphrocallistes beatrix* from Stat. 300, seen surface on. × 80.

From the general appearance and characters of the skeleton, it might be judged that the fragments in question should be classed, not with *orientalis*, but rather with the relatively thick-walled specimens from the Bali Sea Stat. 12, the Banda Sea Stat. 226, the Kur I. Stat. 251, and the Ceram Sea Stat. 177.

The case is different, as it appears, with the *Aphr. beatrix* from the middle of Timor Sea (10°47′ S., 127°15′ E.: 82 m.), which is referable to the same form (*orientalis*) as that of the Japanese coast. The specimen was collected by Mr. Maclear Ladds from a reclaimed submarine cable, together with *Farrea hanitschi* n. sp. and *Aulocystis zitteli sibogae* n. subsp. It represents a small and probably young stock, consisting, as it does, of thin-walled tubes only 3—5 mm. in diameter. Radial canals 0.5—0.7 mm. wide. Dictyonal skeleton profusely and fairly uniformly beset with rather coarse tubercles in all parts; the mesh-spaces on the whole much smaller than in the specimens from Stats. 280 and 300. The dermalia are mostly nearly regular pentactins with a low knob in place of the atrophied sixth ray; rarely the knob takes the form of a quite rudimentary pinular ray. Scopules in two forms, both of essentially the

1) This figure is here inserted especially because it happens to clearly bring out, thanks to the swollen state of the axial canals in the original preparation, the irregular disposition of the hexactins in building up the dictyonal reticulum. Sollas (1877, p. 22) has pointed out the following sexradiates in septa of *Aphrocallistes*, with figure illustrating the condition. "In *Aphrocallistes* imbedded sexradiates are subject to great variations in the disposition of their rays, five or even all six, radii being sometimes brought into one plane, while two or more of these rays may be and often are enveloped in one and the same layer; so that the nodes of the resulting network are as often as not sexrotulate in the same plane, and the intermeshes consequently triangular". Not all the nodes are true ones containing a spicular center, but they are frequently brought about by the joining together, at varying position and angles, of rays coming from different spicular centers. Relatively seldom do the six canals arising from a common center run into as many beams at right angles with one another; more frequently they are more or less bent after origin, and that sometimes even to such a degree that they come to lie all in nearly the same plane. Thereby, the canals extend, not necessarily into as many separate beams but more usually into less than six beams, so that at times a single beam may be traversed by two or even three beams emanating from one and the same center.

same appearance as those of *Aphr. beatrix orientalis*. Hexasters common, all in the form of small discohexasters, mostly regular and seldom elongate, 32—56 μ in diameter or length. Without oxyhexaster.

5. Ceram Sea.

Stat. 177 (between Ceram and Misool Islands; 1633 m.).

This Station has yielded two incomplete specimens, of which the largest is shown in pl. XXV, fig. 5. Both are tubular and approximately of the thickness of one's finger, but show a marked lateral compression. The specimen figured is, at about the middle of its length, 18 mm. thick in one direction and 12 mm. in another. The wall is in most parts 1—2 mm. thick; radial canals 0.6 mm. and over, frequently reaching 1 mm. or even slightly more, in width. In general appearance and dimensions of the gross parts, the specimens appear to stand in close agreement with those from the south-western coast of Sumatra, which were figured by F. E. Schulze in the "Valdivia" Report. Compared with the specimen obtained by the Siboga at her Stat. 12 in Bali Sea, the honeycomb-like meshes of skeleton are on the whole perceptibly larger and just slightly less regularly hexagonal; otherwise the agreement is here again nearly complete. Both the specimens in question are in the bleached state, except in a small part of one where I have fortunately found the loose spicules in a good state of preservation.

The septal skeleton is thin and flat, with beams and nodes lying mostly in a single layer. The beams are sparsely and irregularly tubercled, more numerously in the deeper, than in the peripheral, parts of the wall. A goodly number of slender spikes stand out on the septal surface, all directed obliquely outwards toward the external entrance into the canal. Similar spikes exist on the external edge of septa; those on the internal (gastral) edge are frequently greatly prolonged and extend longitudinally subparallel with the gastral surface. In all these respects the skeleton is essentially similar to that represented in pl. XXIV, fig. 20.

Free parenchymal oxyhexactins numerously present; with slender, straight or gently bent, obsoletely rough and 35—130 μ long rays. The same hexactins are frequently found in fusion with the dictyonal framework, especially in the deeper parts of the wall.

The dermalia (pl. XXV, fig. 11) are generally well developed pinular hexactins with tangentials of 80—110 μ length and with the proximal ray about as long. The distal pinular ray, 90—145 μ (mostly above 100 μ) long, consists of a rhachis, which may be nearly 10 μ thick at base, bearing rather strong looking lateral spines in the distal $^3/_4$ of its length. The longest spines reach up to 24 μ in length. The plumose parts of the ray measure 24—40 μ across transversely in the middle. The pinule differs very notably in its appearance from that of the specimen from Stat. 12 in Bali Sea, as will at once be seen by comparing pl. XXV, fig. 11 with pl. XXIV, fig. 21. Sometimes the pinular ray is more or less rudimentary (fig. 11, *a*); quite exceptionally it may even be nearly entirely suppressed, thus converting the spicule into a pentactin.

The gastralia are rough diactins 232—500 μ long and of the usual appearance.

The uncinates are slender, up to 1.5 mm. long or somewhat longer, and without noteworthy points of characterization.

Scopules occur in the usual two varieties. The pachyscopule is common; it is 400—490 μ

long, with very weakly sigmoid terminal branches 56—70 μ long, which occur four together at a time (pl. XXV, fig. 6). The leptoscopule is much less common; it is moreover smaller, measuring 290—400 μ in total length. The slender and nearly straight terminal branches, 48—56 μ long and numbering 4—6 together at a time, arise from a 4-knobbed swelling at the shaft end and terminate each with an insignificant swelling at the tip (pl. XXV, fig. 7).

The hexasters are mostly small discohexasters or tylohexasters, rarely oxyhexasters. The discohexaster (pl. XXV, figs. 9, 10), occurring in great abundance, is nearly always regularly developed, generally measuring 28—45 μ in diameter. In exceedingly rare instances it showed one of the principals somewhat longer than any of the others. The central node is often, but not always, spherically swollen; the principals are short and moderately strong; terminals four or five to each principal, quite fine in some spicules but much stronger in certain others, ending with small pinhead-like swelling which scarcely or not at all shows marginal dentation.

Regular oxyhexasters with very fine tapering terminals were met with in isolated occurrence (pl. XXV, fig. 8). They are mostly of about the same size as the discohexaster, but are sometimes appreciably larger (up to 56 μ diameter). In certain instances, a rosette which I at first took for an oxyhexaster was found, on employing a higher power of the microscope for observation, to have terminals ending each with just an indication of a terminal swelling.

The above Ceram Sea specimens, closely similar though they are in the appearance and structure of dictyonal skeleton with the specimen from the Siboga Stat. 12 in Bali Sea (pl. XXIV, figs. 20—30; pl. XXV, figs. 1—3), seem to stand very considerably at variance from this, as before noted, in the shape and development of dermal pinules, and besides, in the characterization of the terminal branches to leptoscopules (cfr. figs. 2 and 7 in pl. XXV) as well as in the development of hexasters, which, in the latter specimen, frequently occur in the elongate oxyhexaster form of 100 μ or over in length (pl. XXIV, figs. 25—27). On the ground of these differences it may well be doubted if the specimens from the two localities mentioned can properly be put together in the same variety or subspecies under *Aphr. beatrix*.

6. Halmaheira Sea:

Stat. 145 (E. of the southern end of Halmaheira; 827 m.) and Stat. 159 (N. of Kofiau I.; 411 m.).

From these Stations there are at hand some few fragments of insignificant sizes, all dead and completely macerated. Wall 0.75—1.5 mm. thick. Radial canals regularly hexagonal in most of the pieces; on an average 0.8 mm. wide. Septal skeleton mostly thin and flat, appearing much like that in all thick-walled specimens from other stations; but the dictyonal reticulum is characterized by the presence of short spines, instead of mere tubercles, all over the surface, though in scattered and not uniform distribution. From the character of the skeleton it is almost certain that the specimens cannot be ranged under *Aphr. beatrix orientalis*, and this is about all that can be said of their status within the species.

7. Sulu Sea.

Stat. 95 (near Pearl Bank, Sulu Is.; 522 m.) and Stat. 105 (near Jolo I., Sulu Is.; 275 m.). Some small and completely washed-out fragments were obtained at these stations. They

are mostly tubular, measuring 4—8 mm. in diameter. The dictyonal skeleton shows no point of important difference from that of the type of "*A. ramosus*" F. E. Sch. (Chall. Stat. 210, at the southern entrance to Cebu-Bohol Strait, Philippine Islands), of which a slide-preparation, kindly given me by Professor F. E. Schulze, stands at my disposal for comparison. Only I notice the dictyonal beams to be somewhat more profusely tubercled than in the said type specimen. It may specially be mentioned that, exactly as in Japanese specimens of the species, the septal dictyonal reticulum is not an evenly flat sheet but one of an irregular thickness. The specimens in question certainly appear to belong to the form I have called *Aphr. beatrix orientalis*.

In connection herewith, mention may be made of a China Sea specimen or specimens (S. of Hainan, 17° 14′ N., 110° 26′ E.; 216 m.; collected by Mr. Maclear Ladds from a reclaimed marine cable), which came into my possession through the kindness of Dr. Hanitsch of the Singapore Museum. They represent small irregular complexes of branching and anastomosing tubes 3—8 mm. in diameter. In macroscopic respects and in spiculation, they may be said to stand well within the range of variation which may be allowed to *Aphr. beatrix orientalis*.

Remarks. — Of all the *Aphrocallistes* material reported on above, those collected at the Siboga Stations 95 (Sulu Sea), 105 (ditto), 312 (Bali Sea) and 256 (Kei Is.), as also those obtained by Mr. Maclear Ladds in China and Timor Seas, are of such a characterization as seems to justify their reception into the form *Aphr. beatrix orientalis* proposed by me in 1916. Under that designation I put together — entirely without regard to the stock being tubular and ramose or calyciform with tubular outbulgings — all those *Aphr. beatrix* in which 1) the body parts are of a somewhat diminutive development, both the wall thickness and the width of radial canals remaining generally well under 1 mm.; 2) the dictyonal skeleton of septa is not complanated into a thin and simple reticular sheet; 3) the dermalia are largely pentactins and only in part hexactins, the latter having the distal ray commonly short-spiny and imperfectly pinular (subpinular, not quite plumose) or even abortive and spineless; 4) the leptoscopule exhibits only a small bulb-like swelling at the end of its branches; and 5) the elongate forms of hemihexasters are weakly developed, not exceeding 100 μ in length. However, the form should by no means be taken for one which is rigidly delimited or sharply defined in any one or all respects. The typical form of the species, or *Aphr. beatrix beatrix* Gray, as known from the studies of Gray ('58, '67), W. Thomson ('68), Bowerbank ('69), Carter ('73) and F. E. Schulze ('87) on the type specimen from Malacca Strait, differs from the form *orientalis* chiefly in the dermalia being fir-tree-like hexactins (F. E. Schulze), in the elongate oxyhexaster being strongly developed to a size of 130 μ or even 170 μ (computed from F. E. Schulze's figures in the Chall. Rep.) and in certain nodes of the dictyonal skeleton being swollen into densely tuberculated spherical knots (Bowerbank, 1869).

The geographical distribution of the form, so far as known, may be put down as the eastern coast of Japan, the Philippines, China Sea, East Indian Seas, and Timor Sea; the bathymetrical range as 82 m. (Timor Sea) to 522 m. (Siboga Stat. 95). In Sagami Bay, where *orientalis* is the only form of *Aphr. beatrix* that occurs, it is met with, according to my experiences, at places very plentifully, at a depth of 100 m. and over. Other form or forms of the species are known from depths of 141—1694 m. in East Indies and the Indian and Atlantic Oceans.

Apparently not referable to the form *orientalis* are the Siboga specimens from Stats. 12 (Bali Sea), 226 (Banda Sea), 251 (Kur I.), 280 (Timor Sea), 300 (ditto), 177 (Ceram Sea), 145 (Halmaheira Sea) and 159 (ditto). These, together with GRAY's old type (preserved in the British Museum) of the species from Malacca Strait, the Indian Ocean specimens collected by the "Investigator" and the "Valdivia" and described by F. E. SCHULZE, and the Atlantic specimens reported on by F. E. SCHULZE, TOPSENT and others, make up an assemblage of *Aphr. beatrix* in which the dermalia, in distinction from those of *orientalis*, seem to be exclusively, or nearly exclusively, hexactins with well-developed (plumose fir-tree-like or poplar-like) pinular distal ray. So far so good, but in the details of the development and appearance of those dermal spicules there exists no uniform agreement in the assemblage, as one will at once note on comparing, e. g., the slenderly poplar-like pinule of the specimen from the Siboga Stat. 12 (pl. XXIV, fig. 21) or of the Atlantic specimen figured by F. E. SCHULZE (1887, pl. LXXXIV, fig. 8) with the much shorter but more strongly spiny pinules of the Siboga Stat. 177 specimen (pl. XXV, fig. 11) or of the Bay of Bengal specimen figured by F. E. SCHULZE (1896, pl. VII, fig. 4). In several other respects of spiculation, and also in the dimensions of body parts (diameter of tubular body, wall thickness, width of radial canals), there are frequently observable not inconsiderable variations in the specimens from different localities; so much so, indeed, that it decidedly appears improper to regard the aforesaid assemblage as anything like an indivisible group under the species. In it are probably represented not only the typical form (*Aphr. beatrix beatrix* Gray), but also some other distinguishable forms, subspecific or varietal, differentiated in relation to geographical or certain physical conditions of the habitat. However, in the present state of our knowledge, it seems scarcely practicable to carry out the subdivision of the species in an adequate way, and we can only give recognition to the form *orientalis* as one distinguishable subgroup under it.

Family CRATICULARIDAE Rauff, 1893.

Euretidae partim, ZITTEL, 1877, p, 35.
Coscinoporidae ZITTEL, l. c., p. 47.
Craticularidae RAUFF, 1893, p. 191.
Auloplacidae partim, SCHRAMMEN, 1910—12, p. 227.
Craticularidae SCHRAM., l. c., p. 232.
Leptophragmidae partim, SCHRAM., l. c., p. 234.
Polystigmatidae SCHRAM., l. c., p. 253.
Stichmapticidae SCHRAM., l. c., p. 255.

Hexactinosa with thin or moderately thick wall, traversed by epirhyses and aporhyses in alternating arrangement.

The Craticularids are generally cup-like, tubular or plate-like sponges with thin or moderately thick wall. The body may sometimes be laterally compressed like a dagger-sheath (Leptophragma). The most important character common to all members of the family lies in the distinct development of alternating intradictyonal epirhyses and aporhyses. Ostia and postica may sometimes occur in a somewhat irregular distribution, but are more commonly arranged either in transverse and longitudinal rows or in two intersecting series of oblique rows. Dictyonal

framework with small and irregular meshes as in certain Euretids. Of the loose spicules nothing whatever is known, but the family is presumably scopuliferous and may provisionally be regarded as representing a highly differentiated offshoot from the stem of the Scopularia. (The family type is the fossil genus *Craticularia* Zittel from the Jurassic, Cretaceous, Miocene).

As will be seen from the synonymy given above, I give a much wider scope to the family than SCHRAMMEN (1910—12) did. That author instituted his Auloplacidae for the two genera *Auloplax* F. E. Sch. and *Stereochlamis* Schram. The former, it seems certain, is a Tretodictyid; while the latter, or at any rate *S. praecissa* with distinctly developed epirhyses and aporhyses, appears to me well acceptable into Craticularidae. Of the same author's Leptophragmidae, the genus *Leptophragma* Zitt. can surely be joined with *Craticularia* in the same family; whereas, in regard to *Pleurostoma* Roem. (*P. radiata* and *P. dichotoma*) I can say from my own observations on samples kindly supplied me by SCHRAMMEN, that it so closely agrees with *Chonelasma* s. restr. and *Ptychodesia* Schrammen in the structure of the dictyonal skeleton that it should not be placed in the same family together with those genera, viz. in the Euretidae. Again, SCHRAMMEN's Polystigmatidae and Stichmapticidae, each founded on a single genus and species, may, in my estimation of their characters, also be regarded to be probably synonymous with the Craticularidae.

A new genus and species, *Tretorete incertum*, obtained by the "Siboga", seems referable to this family. It will be the only recent Craticularid as yet known.

Genus **Tretorete** n. g. [1]).

1. *Tretorete incertum* n. gen., n. sp. (Plate XVIII, figs. 18—21).

Stat. 105. 6° 8′ N., 121° 19′ E. 275 m. 3 specimens.

Diagnosis. — Sponge small, simply tubular, thick-walled, erect, truncate above, somewhat contracted toward base; with terminal osculum at upper end, leading into deep gastral cavity, without lateral oscula. Skeleton showing on dermal surface numerous crowdedly but uniformly distributed ostia of jagged outline, and on gastral surface numerous larger postica of longitudinally elongate shape, arranged in longitudinal rows. Dictyonal framework irregularly small-meshed; beams with conical tubercles, best developed and densely present on those near dermal and gastral surfaces. Loose spicules not known, except uncinate and oxyhexaster. The latter with long principals and strongly divergent terminals.

Description. — At Stat. 10, near Jolo Island, Sulu Archipelago, were obtained the three specimens on which this new genus and species are based. Unfortunately they are all nearly completely washed-out specimens, though they were probably living at the time of capture.

It may summarily be stated that the sponge is of a small tubular shape, thick-walled, circular in cross-section, truncate at the oscular end and gently narrowed towards the other extremity which may finally terminate with a slightly swollen or expanded base for attachment. It must have stood erect on the substratum. A deep pit-like gastral cavity extends from the osculum right to the basal attachment mass. The general appearance of the sponge resembles that of SCHRAMMEN's fossil *Stereochlamis praecissa* (1912, p. 231).

1) Unfortunately a definition of the genus is missing in the manuscript of the late Prof. I. IJIMA. M. W.

The first specimen, that shown in pl. XVIII, fig. 18, has the body just perceptibly bent and 26 mm. high. The diameter close to the upper end is 7.5 mm.; that just above the knob-like basal mass, 3.5 mm. The roundish osculum at the upper end measures 3—4 mm. in diameter. The wall in the middle parts of the sponge is 1.5—2 mm. thick.

The second specimen is of quite a similar habitus; only it is smaller, measuring 21 mm. in height.

The third specimen is a fragment of the wall of an individual which must have been somewhat larger than the first. The wall is about 2 mm. or a little over in thickness. Dermal and gastral views, twice magnified, of this fragment are shown in pl. XVIII, figs. 19 and 20.

All the specimens agree in the appearance of the dermal and gastral surfaces. On the former (fig. 19) are seen numerous small ostia or orifices into incurrent canals, occurring pretty close to one another. They are not round, but irregularly shaped with jagged or indented outline. The postica or the openings of excurrent canals on the gastral surface (fig. 20) are larger apertures, generally longitudinally elongate in shape and arranged in longitudinal rows.

The dictyonal framework (pl. XVIII, fig. 21) is small- and irregular-meshed. The meshes, generally under 200 μ across, may be roundish or variously shaped but always with rounded corners. The beams, up to 58 μ thick, form nowhere continuously straight fibers of any great length. They are rough, due to the presence of small conical tubercles. The tuberculation is strongest on beams superficially situated, both dermally and gastrally. On other beams the tubercles are weaker and at the same time more sparse. At certain places of the skeleton some small oxyhexactins with slender short-spiny rays (70 μ long) were met with, attached with one of the rays to dictyonal beams. The densely tubercled spikes are short, being of a conical or elongate conical shape. At their base the superficial dictyonal nodes are gently swollen.

A few cases of oxyhexasters, looking much like those of *Farrea*, were met with during the study. They were provided with long principals, each of which bore 2 strongly divergent terminals. Further some uncinates were observed, caught among the dictyonal network. No other loose spicules could be discovered in the specimens.

In view of the fact that so little is known of the loose spicules, the exact systematic position of the genus and species must remain undetermined.

Tribe B. LYCHNISCOSA Schrammen, 1903.

Lychniskophora, SCHRAMMEN 1902, p. 7.
Lychniscosa, SCHRAMMEN, 1910—12, p. 188.

Hexasterophora with dictyonine skeletal framework consisting of hexactins which are all or commonly lychniscs.

The ground for my accepting SCHRAMMEN's Lychniscosa as a tribe of the Hexasterophora I have already indicated on p. 211 of this work. It essentially consists in this that that group, typically dictyonine as it is in agreement with the Hexactinosa, apparently arose, independently of this, from a form of the Protohexasterophora by fusion of its free skeletal hexactins which all or in part had previously developed, the peculiar pericentral buttresses (the so-called lantern

node or perforated node) and so had changed into the lychnisc; while, on the other hand, the Hexactinosa can be regarded as representing another branch which had sprung out from a different form in the same common stock in which the corresponding hexactins persisted all and always in the original simple state.

I have formerly entertained an idea that all the lychniscophorous Dictyonina could be united with certain non-lychniscophorous dictyonine forms, the Dactylocalycidae, into a common tribe (Tribe B, IJIMA, 1903, p. 25, footnote). Since I now no longer believe in the tenability of the Dactylocalycidae but would have the genera, once referred to it, distributed under another tribe (Tribe C, l. c.) which then becomes identical in scope with SCHRAMMEN's Hexactinosa, there remain the lychniscophorous forms, i. e., the Lychniscosa, representing by themselves alone a distinct tribe. I beg herewith to withdraw all my former criticisms against the acceptability of SCHRAMMEN's Hexactinosa and Lychniscosa (IJ., l. c., and Postscript I).

F. E. SCHULZE (1904, pp. 170, 171) has, in agreement with my old view and as an objection to SCHRAMMEN's Lychniscophora or Lychniscosa as a suborder under the Hexactinellida or a tribe under the Hexasterophora, expressed the opinion that the twelve pericentral buttresses characteristic of the lychnisc are secondary and accessory formations to the dictyonal hexactin, and can be utilized at the most to base family distinction on. There can be no doubt whatever that the buttresses are accessory formations to the hexactin, but the above limitation to the taxonomic value of the lychnisc seems refutable, in as much as it obviously rests on the premise, which I think is unfounded, that those accessory parts were added to the hexactins after these had been previously joined into a connected dictyonal skeleton. From the point of view, which I now accept to be the correct one, that the dictyonal skeleton of the Hexactinosa and of the Lychniscosa is of an independent origin from the lyssacine skeleton of the Protohexasterophora, the two groups may be looked upon as parallel series, either of which may be given the same systematic status as the other. Were all the lychniscophorous species, including those known as fossils in their multifarious development of form and canalization, to be made a single family, that family would be one to which must be ascribed a variation range most incongruously wider than that usually allowed to any Hexactinellid family. They can surely be regarded to represent a number of families which can be put together into one common group, the Lychniscosa, to be placed upon a par with the Hexactinosa. Even among the living remnant of the lychniscophorous forms there exists a form — the new genus and species *Diapleura maasi* brought to light by the "Siboga" — which, in an attempt to keep up consistency with the classification of the Hexactinosa into its families, must needs be made to represent a family distinct from the Aulocystidae, the only living lychniscophorous family hitherto known.

Like the Hexactinosa, the Lychniscosa are all basiphytous forms and are therefore provided with a basidictyonal mass differing in no important respect from that of other tribes of the Hexasterophora. Certain species, as, e. g., *Aulocystis zitteli*, appear to occur generally on the bottom of loose gravels and shell fragments, but are not to be regarded on that account as exceptions to the above rule, since they usually exhibit small isolated attachment points to those loose bottom objects and under circumstances may be found attached by a broad base to a firm substratum (as, e. g., *A. zitteli* on the submarine cable). The basidictyonalia in the Lychniscosa may readily be recognized as a structure older than, and genetically independent of, the lychnis-

cophorous dictyonal skeleton of the choanosome; that is to say, as a structure which must have existed already in the basiphytous Protohexasterophoran ancestor (Protolychniscophora) with its choanosomal supporting hexactins developed into lychniscs but still remaining free and unconnected with one another.

As has been justly remarked by SCHRAMMEN (1910—12, p. 189), there is in the Lychniscophora a repetition of the various types of body-form seen in the Hexasterophora, besides an occurrence of some other form types peculiar to the group; further there recur in the former almost all the important modifications of canal-system which are found in the latter. The parallelism in the evolution of the two tribes may be looked upon as being largely a phenomenon consequent to the close agreement in skeletal structure which existed between the ancestral forms of both the groups, save that the hexactins concerned had pericentral buttresses developed in the one but not in the other.

The skeletal wall of the ancestral Lychniscosa must have been a quadrate-meshed framework, with mesh-spaces only and as yet without any intradictyonal canals. The condition must have been essentially like that seen in *Farrea* or in the Euretidae generally. In the later evolution of the Lychniscosa the regular arrangement of lychniscs in relation to one another, so as to bring about quadrate-shaped meshes, has well preserved itself throughout the entire group. The original non-canalized state of the dictyonal skeletal wall has persisted in quite a number of forms, as, e. g., in the recent family Aulocystidae F. E. Schulze and in the fossil families Camerospongidae Schram. (probably inseparable from the Aulocystidae), Callodictyonidae v. Zittel, Becksidae Schram., Calyptrellidae Schram., Microblastidae Schram., Polyblastidae Schram., and possibly some others. In the said respect of the dictyonal wall, all these forms may be said to stand in the same inceptional stage of development as the Euretidae under the Hexactinosa. The schizorhysis of the Tretodictyidae seems to recur in the new Lychniscosan family Diapleuridae and perhaps also in the fossil Bolitesidae Schram. The intradictyonal epirhysis and aporhysis of the Craticularidae are exquisitely repeated in the Coscinoporidae v. Zitt.; while those of extradictyonal or cavaedial origin, following the folding of the sponge wall, are plainly represented in the Ventriculitidae. Amarorhysis and diarhysis, so far as can be gleaned from the literature, do not seem to have their parallels in the Lychniscosa.

Further to dilate on the general morphology of the tribe will be surpassing the limit of my province.

Family AULOCYSTIDAE F. E. Schulze, 1904.

Aulocystidae, F. E. SCH., 1904, p. 180.
Maeandrospongidae partim, F. E. SCH., 1886, p. 84; 1887, pp. 341, 402.

Massive or calyx-like. The entire body, or when calyx-like, the wall around the central main cavity, consists of parietal tubes and intercanals of similar appearance. The two canal systems sometimes intercommunicate with each other. The external body surface may largely be covered by a secondarily produced covering layer.

Genus **Aulocystis** F. E. Sch., 1886.

Aulocystis F. E. Schulze, 1886, pp. 356—359; p. 405.

Aulocystis F. E. Sch., 1886, is the only genus of the family, which is known with certainty. The W. Indian sponges which were described by O. Schmidt (1880) separately under the names of *Cystispongia superstes*, *Scleroplegma lanterna* and *Diplacodium mixtum*, are apparently all Aulocystids, but are so inadequately known that no definite systematic treatment can be given them.

Of *Aulocystis* two species have hitherto been known, viz., *A. grayi* (Bwbk.) and *A. zitteli* (Marsh. and Mey.). It would be worth while to put down here some facts about these forms, as being not without bearing in determining the status of the Siboga material belonging to the genus.

1. *Aulocystis grayi* (Bwbk.) [1]. The species was first described by Bowerbank from a specimen in the British Museum, which came from St. Vincent, W. Indies. The same specimen was later studied in detail by Carter (1877) as well as by F. E. Schulze (1887). The sponges, on which O. Schmidt reported in 1880 under the name of *Myliusia zitteli* and which likewise came from W. Indies (Barbados, 100 fms., Guadeloupe, 150 fms.), are held by F. E. Schulze (1900 *d*, p. 5) to be specifically identical with the type of Bowerbank from St. Vincent, — a conclusion which seems well borne out by all the facts known about the specimens concerned. It is evident from the accounts and figures by the above investigators that typical *Aulocystis grayi*, known from the waters of W. Indies, is a massive — not calyciform — sponge consisting of tortuous, anastomosing, tubular canals separated by equally tortuous and labyrinthic intercanals. In the absence of a wide and distinct central gastral cavity it seems to agree with *Aulocystis zitteli* (Marsh. and Mey.) of the Philippines and the East Indian Seas. The gastral canals and the intercanals are about equally wide and alike in appearance, making it difficult to distinguish between the two at a glance. These are both moderately wide, measuring 4 or 5 mm. or more across, as estimated from the natural size figures given by Carter (1877, pl. IX, fig. 8) and O. Schmidt (1880, pl. VI, fig. 5). The lantern-knots of the dictyonal framework measure, according to Carter, 14—1800th inch (= about 200 μ) in diameter. The hexasters of the species are known to be a small spherical kind of discohexaster with short principals and a kind of hexaster which may be designated as the graphiocome.

The "Pola" expedition obtained in the Red Sea (490—868 m.) several small specimens of *Aulocystis*, which were carefully studied by F. E. Schulze (1900 *d*) and unhesitatingly placed under *A. grayi* (Bwbk.), on the ground of a nearly complete agreement in spiculation with that from W. Indies. Nevertheless, it should be pointed out that there does seem to exist a notable and apparently constant difference in macroscopic respects between the Red Sea and the W. Indian specimens, viz., in the fact that the former are distinctly calyx-like in shape, being provided with a comparatively wide and funnel-like central gastral cavity which is not known to occur

1) Synonyms and literature:
Myliusia grayi, Bowerbank, 1869, p. 335; pl. XXIII, fig. 8 and pl. XXV, fig. 1. — Carter, 1873, p. 365. — Carter, 1877, p. 126; pl. IX, figs. 8—17. *Myliusia zitteli*, O. Schmidt, 1880, p. 51; pl. III, figs. 11, 12; pl. IV, fig. 5; pl. VI, fig. 4. — Weltner, 1882, p. 17. *Aulocystis grayi*, F. E. Schulze, 1886. — F. E. Schulze, 1887, p. 359; pl. CIV, fig. 7. — F. E. Schulze, 1900 (*d*), p. 1; pl. I.

in the latter, and in the lateral parietal tubes (2 mm. wide in average) of the Red Sea specimens, being much narrower than the meandering tubular canals of the W. Indian specimens. Possibly the former are immature individuals, but it can scarcely be imagined that they will in time grow into the shape and proportions of the latter. Perhaps a further not unimportant difference consists in the dictyonal beams being beset with conical tubercles apparently more profusely in the Red Sea form than in the W. Indian. In view of these differences, which certainly demand to be duly accounted for, I am greatly inclined to assume the two forms to be at least subspecifically distinct. The Red Sea form may be referred to by the name of *A. grayi polae*, in distinction from *A. grayi grayi* of W. Indies.

2. *Aulocystis zitteli* (Marsh. and Mey.). The type of this species came from Cebu, Philippines. To the species were referred by F. E. Schulze the *Aulocystis* which the Challenger obtained at her Stat. 192 (S.E. of Taam I., Banda Sea; 257 m.) and Stat. 194 A (N.E. of Banda I., 659 m.) Thanks to that author's careful studies on both the type in the Dresden Museum and the Challenger specimens (1900*d*), we have a pretty exhaustive knowledge of the organization of the species. We have here to do with a sponge, which, though presumably it may present a small, somewhat cup-like shape at the inceptional stage of growth, is in the grown-up state massive without a manifest central gastral cavity. A membranous layer, with here and there star-like clefts, covers the external surface of the sponge more or less extensively. The internal anastomosing passages — of both the parietal tubes and the intercanal system — are as wide as one's little finger or wider in the peripheral parts of body. They are therefore considerably wider than in *A. grayi*, as the sponge body itself probably attains a much larger size (as large as a little man's fist) than in that species. The excellent figures of the dictyonal framework of *A. zitteli*, which were given by F. E. Schulze, accompanied by definite statements of the scale of magnification, from one of the Challenger specimens obtained at her Stat. 192 (1887, pl. CIV, fig. 3 and 1900*d*, pl. II, fig. 3), give an idea of its being made up of much more robust beams with larger lantern-knots, and of its meshes being considerably wider than in *A. grayi* or at any rate in *A. grayi polae* (F. E. Sch. 1900*d*, pl. I, fig. 5). By computations from the said figures, it is to be seen that the lantern-knots in the specimen referred to of *A. zitteli* must have commonly measured 250 μ and over, reaching up to nearly 300 μ or even still more, in diameter (measured between two diagonally opposite edges of octahedron through the spicular center). This is a size not inconsiderably larger than that given by Carter for the lantern-knots of the W. Indian *A. grayi grayi* (about 200 μ in dia.), and approximately twice as large as those figured by F. E. Schulze for *A. grayi polae*. But there is room for doubt if the large size of the lantern-knots in *A. zitteli* is a constant and reliable fact, since the figures of same as given by Marshall and Meyer (1877, pl. XV, figs. 10, 17) from their Phillippine type specimen indicate a much smaller size, fluctuating between 100 μ and 150 μ in diameter. Of hexasters, there is an isolated occurrence of the same two forms, viz., the small spherical discohexaster with short principals (50—60 μ dia.) and the graphiocome, as those found in *A. grayi*; but the commonest and the characteristic form of hexaster present is the large discohexaster in which the prolonged principals bear each a conical tuft of slender terminals about as long as the principal. This, for the convenience of reference, may be called the lophodiscohexaster. According to F. E. Schulze, it measures 100 μ and over in diameter.

On a slide preparation, kindly given me by Professor F. E. Schulze, of the species from Chall. Stat. 192, I observe that the lophodiscohexaster may be so large as to reach 153 μ in diameter, and that it easily attracts one's attention, even under moderate magnification, on account of its relatively large size and the frequency of its occurrence.

In the Siboga collection there are contained two small fragments which may provisionally be referred to typical *A. zitteli*, and numerous more specimens which I make into *A. zitteli sibogae* n. subsp., and *Diapleura massi* n. g. et sp., besides some further fragmentary pieces which cannot be satisfactorily determined.

At present I distinguish four forms of *Aulocystis*, as follows:

A. Sponge of massive shape, not calyciform.
  a^1. With lophodiscohexaster.
    a^2. Tubes and intercanals as wide as one's little finger. Lophodiscohexaster 100—153 μ in diameter . . . . . *A. zitteli zitteli* (Marsh. & Mey., 1877).
    (Philippines; Little Kei Is.; near Banda I.; ? Samau Strait, Timor).
    b^2. Tubes and intercanals not wider than 5 mm. Lophodiscohexaster 35—57 μ in diameter . *A. zitteli sibogae* n. subsp.
    (W. of Great Kei I.; Timor Sea; Solor Strait).
  b^1. Without lophodiscohexaster (Tubes and intercanals about 5 mm. wide) . . . . . *A. grayi grayi* (Bowerbank, 1869).
  (W. Indies).

B. Sponge calyciform, with deep central gastral cavity. Parietal tubes short, distinct, with lumen of about 2 mm. average width . . . . . *A. grayi polae* n. subsp.
  (Red Sea).

1. *Aulocystis zitteli zitteli* (Marsh. and Mey., 1877)? (Plate XXVI, fig. 21).

Myliusia zitteli Marshall and Meyer, 1877, p. 266; Pl. XXV, figs, 16—17. Not O. Schmidt, 1880, p. 51; nor Weltner, 1882, p. 72.
Aulocystis zitteli F. E. Schulze, 1886. — Ditto, 1887, p. 361; pl. CIV, figs. 1—7. — Ditto (1900(*d*), p. 6; pl. II.

Stat. 59. 10° 22′.7 S., 123° 16′.5 E. 390 m. 1 small fragment.
Stat. 105. 6° 8′ N., 121° 19′ E. 275 m. 1 small fragment.

Diagnosis. — Massive, reaching the size of a man's fist; made up of a system of anastomosing thin-walled tubes, as thick as a finger, and of an irregular system of wide intercanals; the whole may be covered externally by a thin layer exhibiting cleft-like or irregularly stellate apertures. Dictyonal framework rectangular-meshed. Hexasters graphiocome, spherical discohexaster with short principals, and lophodiscohexaster; the last the commonest form, over 100 μ in diameter.

Description. — Two little fragments collected by the Siboga are referred to typical *A. zitteli* with much reserve, owing to their incompleteness. I would have hesitated still more in taking this step, were it not for the fact that the fragments are from about the same part

of the world as the form just mentioned. Both the Siboga specimens have preserved no trace of the loose spicules.

One is from Stat. 59 (Western Entrance to Samau Strait, W. end of Timor). It is a piece of dictyonal plate, 10 mm. by 8 mm. and 1—1.5 mm. thick (pl. XXVI, fig. 21). The latticework is in the main regularly rectangular-meshed, being made up of lychniscs arranged in 3—5 tiers in cross-section. Free spikes are present on both surfaces of the plate. The meshes are mostly 535—670 μ long and 300—500 μ wide; the beams 50—90 μ thick, with small tubercles which show a tendency towards being arranged in transverse rows. Lantern-knots 185—216 μ thick as measured between middle points of diagonally opposite buttresses. Compared with the latticework of *A. zitteli sibogae*, the piece in question differs manifestly in the larger size of the meshes, in the stronger beams, and in the larger lantern-knots.

On both surfaces of the latticework, the regularity of the structure is much disturbed by the presence of some small or medium-sized hexactins in accretion to the beams as well as to one another in an irregular disposition. The hexactins show no lantern formation around the center. At one spot they form, by concentration as it were, a whitish body (WELTNER's "nest") of about 2 mm. size. The body, consisting of an irregular small-meshed siliceous network, is hollow and open on one side of the plate, presenting a great resemblance to a bird's nest in general appearance. No free spicules have been observed in the specimen.

The second fragment is from Stat. 105 (off to north of Jolo Island, Sulu Islands). It is an irregular-shaped piece of skeleton, not larger than the tip of one's little finger. In character it agrees fairly well with that of the specimen from Stat. 59 in all respects.

2. *Aulocystis zitteli sibogae* n. subsp. (Plate XXVI, figs. 1—16. Textfig. 36).

Stat. 260.	5° 36′.5 S., 132° 55′.2 E.	90 m.	13 specimens.
Stat. 289.	9° 0′.3 S., 126° 24′.5 E.	112 m.	7 specimens.
Stat. 305.	Solor Strait.	113 m.	1 specimen.
Timor Sea.	10° 47′ S., 127° 15′ E.	82 m.	2 specimens.

Diagnosis. — Like *A. zitteli zitteli*, but differing from it in the narrower tubes and intercanals, both of which are generally not more than 5 mm. wide, and in the lophodiscohexaster being much smaller (35—57 μ) in diameter.

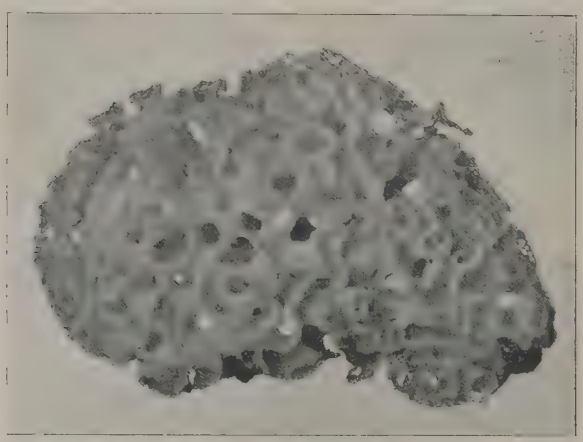
Description. — At Stat. 289, a spot lying off the southern coast of the eastern part of Timor, the Siboga obtained seven more or less complete specimens of this new subspecies. The two largest in this lot of specimens are shown in pl. XXVI, figs. 1 and 2. The original of fig. 1 is somewhat pear-shaped, 49 mm. long and 34—41 mm. broad in the broadest part. That of fig. 2 is of a cake-like or depressed ellipsoidal shape, 35—43 mm. in horizontal diameter and 24 mm. high. A third specimen is subglobular, measuring 27—30 mm. in diameter. The rest are still smaller and in part more or less incomplete, the smallest being 17 mm. broad and 13 mm. high. They may be said to be of much the same appearance as those immature specimens from Stat. 260, of which I have represented three in pl. XXVI, figs. 14—16.

From Stat. 260, off Elat on the western coast of Great Kei Island, there are not less than thirteen specimens which may be referred to the same subspecies as the above. They are of various sizes. The larger ones are incomplete, while the smaller ones (pl. XXVI, figs. 14—16)

have well preserved their shape. They may be summarily described as irregular tubes in different stages of dividing into a complex of branch tubes. The external covering layer is developed in none, except a medium-sized individual, in which a trace of it was discoverable in a small part of the periphery. Most of the specimens have lost the loose tissues. In macroscopic as well as microscopic characterizations, the agreement with the above Timor specimens may be said to be complete; only, it was noted that the lophodiscohexaster occurred exceedingly rarely in the present specimens, so far as the state of preservation of these made the observation possible. And, had that peculiar discohexaster been overlooked, as indeed it might easily have been without a prolonged search for it, it would have been necessary to identify the Great Kei I. specimens with *A. grayi grayi*, instead of with *A. zitteli sibogae*, since almost the only important difference between these two forms consists in the absence or presence of the lophodiscohexaster. Possibly the two forms merge into each other.

At Stat. 305, in the Solor Strait, between Solor and Adonare Islands (E. of Flores), the Siboga obtained an incomplete and mutilated specimen, besides some fragments, of *Aulocystis* which may possibly be of the same form as that from Stats. 289 and 260. No loose spicules could be discovered in the Solor specimens.

Finally, I may here record two beautifully preserved specimens from the middle of Timor Sea, which I do not hesitate in identifying with *A. zitteli sibogae*. They are a part of sponges collected by Mr. MACLEAR LADDS from a submarine cable reclaimed from a depth of 82 m. at lat. 10°47′ S. and long. 127°15′ E. (about midway between Timor and Australia), and presented by him to the Raffles Museum in Singapore. The two specimens in hand were kindly given me by Dr. R. HANITSCH, director of that Museum. Both (one shown in textfig. 36) are irregularly oblong clumps of anastomosing tubes and intercanals, closely resembling *Farrea* or *Eurete* stocks of a similar development. One is 85 mm. × 54 mm. large, the other 92 mm. × 55 mm. × 30 mm. They both show nowhere a distinct trace of a covering layer, the tubes as also the intercanals being all open at the external end, — a fact which may possibly stand in relation to the condition of the environment. The tubes and their arrangement are essentially as in the type of the subspecies from Stat. 289, except in the tube wall being perceptibly thinner and of a somewhat more delicately structured appearance. In most parts of the stock there are only 2—3 tiers of lychniscs in the thickness of the wall.



Textfig. 36. — *Aulocystis zitteli sibogae* Ij.
One of the two specimens from the middle of Timor Sea, now in the Sci. Coll. collection, Tokyo; Mr. MACLEAR LADDS coll. Natural size.

For further description of the subspecies, I select the two large specimens shown in pl. XXVI, figs. 1 and 2 (from Stat. 289), calling them specimens A and B.

Specimen A (fig. 1), the best preserved of all the specimens from the same locality,

shows several adherent foreign objects (pebbles, shell fragments) in scattered distribution on one side of the narrowed body end as well as of the bulbous parts. That side of the sponge was evidently the lower, with which it had lain on the pebbly and shelly sea-bottom. The narrowed body end is presumably the part with which the individual, in the beginning of its development, first attached itself to a loosely lying bottom object or objects; as the growth proceeded, it apparently came into attachment at several more points. Pl. XXVI, fig. 1 represents a view of the specimen taken on the side which I regard to be the upper. The entire sponge surface, both above and below, is covered with a moderately well-preserved covering layer, except at the large and small apertures which open in a limited number on the surface, mostly, but not exclusively, on the upper side. In fact, the general appearance of the sponge is essentially like that of *A. zitteli zitteli*, most elaborately described and figured by F. E. Schulze in the "Challenger" Report.

The external covering layer is thin, soft and delicate, and shows special spiculations, as will be described farther on. It is usually nearly translucent in the middle of each of the irregular or tortuous areas bounded by the line of their junction to the edge of the rigid tube wall below, which junction line appears on the surface as opaque sinuous bands of ill-defined width. I believe the layer normally never becomes rigid by fusion of its spicules. The external surface of the layer is somewhat uneven. Under the lens it appears in part granular, and in part felt-like. Fine and inconspicuous needles project out singly or in small groups here and there on the external surface. In the topmost parts of the sponge and over a considerable area between the large apertures situated there, the needles occur numbers together like hairs.

The apertures on the external covering layer may be oval, but are more usually irregularly shaped and sometimes cleft-like and small. From the obviously intact state of the rim, there can scarcely be a doubt as to their being natural openings, and not those which were produced by a mechanical breaking off of the covering layer. The larger apertures, several of which exist on the upper side of the bulbous body parts and which may measure 5 mm. across at the maximum, are seen to lead into deep-going canals; the wall of these dipping down from the rim either nearly vertically or with a curvature concave on their inside. The apertures, irrespective of their size or shape, are confined in their relation to neither of the internal canals: some of them lead into the gastral canals, others into the intercanals. This is incontestably clear where two closely adjacent apertures open below, each by itself, into two internal spaces between which there intervenes but a single septal wall. Some of the apertures, but especially the smaller or narrower ones, are no doubt to be looked upon as transient gaps, which are on the way of being completely closed up as the covering layer advances in formation. One is strengthened in this belief from the presence of spots in the layer where this is unusually thin or irregularly perforated in a sieve-like manner and which thus may well be considered to be places of the closure having but lately taken place or being on the verge of completion. If the gastral and intercanal passages will ever become shut in, all and everywhere, by the covering layer seems to me doubtful. More probably there will remain, even in the oldest individuals, some free apertures in the layer at certain favorable parts, for the ingress and egress of water according to their position over intercanal or gastral spaces. I concur with F. E. Schulze in the opinion that the covering layer is an arrangement for preventing the free

intrusion of loose foreign objects, such as apparently abound on the bottom inhabited by the sponge, into the cavernous interior of the body.

The covering layer does not, in my view, form itself so long as the sponge is growing in girth and new parts are being added to the tubes in the periphery. This is sufficiently borne out by the young and small examples from Stats. 289 and 260 being nearly all without a trace of the layer. The layer apparently begins to develop late in life, as a secondary addition. And I am inclined to think that under certain conditions it may even never come at all into development during life, as indicated by the large and well grown specimens, before mentioned, from a submarine cable and not improbably in a situation free from the obtrusive bottom objects that might serve as a stimulus to its development.

Genetically the covering layer is, as may be inferred from its structural relations, a lateral membranous outgrowth from the free peripheral edge of the septum-like tube wall. F. E. SCHULZE (1887, p. 362; 1900*d*, p. 8) has called attention to the fact that the layer does not contain flagellated chambers. This I can fully corroborate from my own observations. Of the soft tissues of the sponge, it is in fact only the trabecular tissue (dermalosome) which seems to be concerned in the formation of the layer, similarly as the dermal layer in all Hexactinellids. Since, now, the chamber layer and the dictyonal framework are correlated structures which always occur in direct association with each other, I cannot believe that the latter will ever be formed in the covering layer of *Aulocystis* that lacks the former. On this point F. E. SCHULZE (1900*d*, p. 6) has expressed himself differently. According to him, the covering layer should originate as a soft membrane but later become firm by the growth of the dictyonal framework into it. In saying this, he has probably confused the real covering layer with the superficially exposed, bridge-like parts of the tube wall itself which at places bound the most peripheral canal-like passages on the outside.

Some palaeontologists seem to entertain, for the covering layer of certain fossil Lychniscosa, an idea of its being expansions of, or any way something derived directly from, certain rays of superficially situated lychniscs; but observations on recent *Aulocystis* precludes any notion about its morphological nature except that it is a soft tissue membrane provided with special spicules for support.

The internal gross structure of the sponge is well shown by specimen B. In this the external covering layer, though still well preserved in the lower parts (pl. XXVI, fig. 2*a*), was to a great extent lost by damage in the upper parts, thus exposing to view on that side the condition of the internal canals (pl XXVI, fig. 2). These are of much the same appearance as is known from *A. grayi grayi* and *A. zitteli zitteli*. A priori, the canals are of two distinct systems, the gastral and the intercanal, separated from each other by the tube-wall. Practically, the two systems are so alike in appearance that it is scarcely possible to distinguish between them, unless recourse be taken to determine by microscopic examinations the incurrent and excurrent sides of the wall. It would be different if there existed a central gastral cavity which could readily be recognized as such and of which the gastral canals are direct continuations; but that is not the case. As a matter of fact, one sees uniform, irregularly branching, meandering and anastomosing canals, generally about 4 mm. wide and in no part wider than 5 mm. The firm tube wall measures about 1 mm. or slightly less in thickness. On the surface of the sponge

the canals are seen to open freely outward in consequence of the loss of the covering layer. These external openings, regardless of which canal system they belong to, are in part simply roundish, oblong or biscuit-shaped, forming the truncate outer end of more or less tubular canals that reach the surface from the deeper parts. For the rest, they are of an irregularly lobed or branched and meandering configuration, representing gaps in the wall along the outer side of tubes that run rather parallel than vertical to the sponge surface. Thus, the peripheral canals concerned take the appearance of tortuously running, open gutters, which stand in communication with a deeper lying system of tubes. One and the same septum-like wall may be so bent sidewise in its course as to overhang now one, and now the other, of the two gutter-like passages separated by it. It sometimes happens that two free-edged walls forming the sides of a gutter-like passage approach each other by the bending in of their edges at opposite points, come into contact with each other over the passage between, and there fuse together, bringing about an arch-like connection between them. Again, two open passages running side by side and separated by a wall, may each be bridged over in the above way at different parts of their course. This indicates that the bridges may be formed over a canal, as well as over an intercanal space of the sponge periphery, without being confined in occurrence to either, — a fact which goes far towards making the two canal systems closely similar in appearance. The tube wall participates with its entire thickness in the formation of the bridges; therefore, it is clear that these bridges contain flagellated chambers supported by dictyonal framework just as in any other part of the tube wall. I mention this merely to contrast the bridges in question with the external covering layer, which is, as before indicated, of essentially different structure.

The tube wall shows on both of its surfaces numerous minute pits — either epirhysial or aporhysial, according to one or the other of the surfaces they open on — situated generally one in each of the superficial checker meshes of the dictyonal framework. At places the wall may exhibit on one surface rugosities, which on the other surface are but very weakly indicated or quite unobservable. Near the margin the wall most readily breaks off on application of a little force, along certain definite lines running parallel to the wall edge. By microscopic examinations it was ascertained that in those weak lines the dictyonal beams are either less strongly developed than in immediately adjoining parts of the wall on either side or remain still quite discontinuous. This backwardness in development of the beams without doubt stands in certain relation to the comparatively recent growth of the parts; but nothing definite can be said of the significance of the weak lines.

It is very readily conceivable that the branching and anastomosing tubes of the sponge arise from an inceptional, simply cup-like condition of the young; in much the same way as do those of *Farrea* stock. As the initiative process in the origin of the tube system in *Aulocystis* is to be considered the formation of parietal bridges, strictly identical with those mentioned before from the periphery of the apparently grown up specimen B. The bridge formation over an open gastral canal should lead, with the growth of the tube, to the branching of that canal into two, while the same over an intercanal space should lead to the establishment of an anastomosing connection between the two canals separated by that intercanal.

In the deep parts of the sponge and at indefinite positions in the labyrinthic passages, I note an occasional occurrence of a thin cribrate membrane, extending either completely or

incompletely across the lumen in a somewhat diaphragm-like way. I can say the partitions occur in both the gastrocanal and intercanal systems. Genetically and structurally they seem to have much in common with the external covering layer; possibly they are something analogous to the similar structure known to exist in the calyciform individuals of *Aphrocallistes beatrix*.

Spiculation. — Dictyonal framework (fig. 12) made up of lychniscs in 3—5 (commonly 4) layers in the thickness of tube wall. Meshes mostly quadratic or rectangular, without taking into consideration the lantern-forming buttresses which round off the corners; length of sides as measured between two adjoining lychnisc centres generally 200—300 μ; rectangular meshes may be 200 $\mu \times$ 400 μ large. Beams in the middle between lantern-knots 20—50 μ, commonly 35 μ, thick; on their surface small conical tubercles, not numerous, isolated or more commonly arranged several together in transverse rows of varying length. Lantern-knots up to about 150 μ and mostly about 124 μ in width between two diagonally opposite buttresses across the spicular centre. Central parts of lychnisc rays inclosed within lantern-knots not more than 20 μ thick, smooth. The buttresses may reach a thickness of 30 μ; each simply rod-like — not perforated — after full development; on their surface with tubercles same as those on the beams between lantern-knots. Freely projecting lychnisc spines present on both surfaces of dictyonal layer, thickly tuberculated on surface, much thinner than connected beams of deeper parts, not longer than 150 μ outside the lantern-knots they spring from. Simple dictyonal hexactins without lantern-knot formation are met with in certain positions but only as rare exceptional occurrences.

Together with the specimens from Stat. 289, there was found a small fragment of the sponge wall, torn off without doubt from young and growing parts of one of the specimens. A part of its margin indubitably represents the oscular rim, being even contoured and provided with a palissade-like fringe of fine projecting needles. The most noteworthy features of the fragment are the facts that the dictyonal framework, though 3—4 or more lychniscs thick right up to the oscular rim, is composed of unusually slender beams and buttresses, and that many of the lychniscs are either entirely or partially free, having all or some of the six rays still unconnected to the general framework. The facts clearly attest to the dictyonal skeleton being here in an early stage of structural development. Isolated lychniscs are nearly exactly same in appearance as those which were figured by F. E. Schulze from *A. grayi polae* and *A. grayi grayi* in the "Pola" report (1900, *d*, pl. I, figs. 8—11). They measure about 300 μ in axial length; rays within lantern-knot about 5 μ thick and just outside of same about 12 μ thick, thence tapering to the free end; both parts of rays with conical tubercles. Lantern-knot 80 μ and over in width between two diagonally opposite sides; the twelve buttresses 7 or 8 μ thick in the middle, tuberculated; each of them broadened towards both ends in the plane of the two rays it connects, and thus taking the form of plates, which are however perforated, from side to side, by one or two openings of varying size. These openings disappear along with the growth in thickness of the buttresses as well as of other parts of the spicule.

Loose intermedial oxyhexactins of simple regular shape and medium size are common in subdermal and subgastral positions, as well as in deeper parts of the choanosome. They measure 76—114 μ, commonly about 95 μ, in length of rays. These are straight, slender and tapering to the outer pointed end; usually not more than 3 μ thick at base. Generally the rays are rather closely beset all over with minute spines which stand out vertically from the surface. Sometimes,

however, the spinules are very low and sparse, giving to the rays only a weakly rough appearance. In no case have I found the oxyhexactins so strong-rayed as are represented in F. E. SCHULZE's figure (1900, pl. II) of a section of *A. zitteli zitteli* from Little Kei Islands.

The dermalia (fig. 12) and gastralia, on the two sides of the tube wall, are scarcely distinguishable in any respect from each other. Both are straight-rayed pentactins of various sizes, of which the tangential crosses are irregularly disposed to one another, without forming a regularly meshed latticework. Moreover, the spicules do not seem to be arranged in a strictly single layer, as are the autodermalia of e. g. Rosellids or Farreids; the tangential crosses are often seen to be superposed one upon another. The free distal ray of the pentactins is sometimes indicated by a knob-like rudiment, but is as often, or perhaps oftener, quite unrepresented. Tangential rays commonly 150—300 μ (exceptionally 120 μ or 370 μ) long and 3—8 μ thick at base; tapering to obtusely pointed outer end; nearly smooth for the most part of their length, or sparsely and obsoletely tubercled, especially near outer end. Proximal unpaired ray nearly as long as, or somewhat shorter than, the tangentials of same spicule; generally rough or sparsely tubercled except in the basal one-third of its length. Hexactine gastralia were not observed with certainty; spicules that looked like them may in reality be loose parenchymal hexactins in subdermal position.

The external covering layer shows spiculation which is quite at variance with F. E. SCHULZE's description of same in *A. zitteli zitteli* (1900, p. 8). It is very desirable to re-examine that form of the species in this regard. In the specimens before me, one observes in the covering layer — better in surface-view preparations than in sections of it — a profuse number of fine but variously thick siliceous fibres, which, running paratangentially in all directions, intersect one another at indefinite angles and thus form a loose sort of feltwork. The fibres may be nearly straight, but are generally bent to a greater or less degree and not infrequently to the extent of being sinuous or even of forming loops. At certain places they run in large numbers side by side, nearly parallel with one another. The fibres are rough on surface, though the thicker ones may be nearly smooth. By carefully following the fibres under the microscope, it can be made out that they are nothing else than remarkably prolonged rays of either pentactins or stauractins. In the pentactins the unpaired ray is relatively very short, and is directed generally proximad in radial way. In certain cases, however, the unpaired ray was found to be also excessively elongated in which case it was bent at base so as to take its course in the covering layer together with the other rays. In length, the fibre-like rays of the spicules in question measure commonly 300—450 μ, exceptionally only about 200 μ and not infrequently over 600 μ, up to nearly 1 mm. Their thickness at base 3—8 μ, rarely over.

Regular pentactins comparable with the dermalia or gastralia before described, occur isolatedly on the inner surface of the covering layer, with the unpaired ray directed distally. They are however of no uniform occurrence, being entirely unrepresented in many parts. The external surface seems to be totally devoid of a special limiting layer of spicules, thus differing from *A. zitteli zitteli* as represented by F. E. SCHULZE (l. c.). The presence of diactine fibres in the covering layer could never be satisfactorily demonstrated; in fact I believe in their total absence, although F. E. SCHULZE has definitely ascribed diactine parenchymalia to the layer (l. c.) of *A. zitteli zitteli*. If the spicules that were taken by that author for diactins, are really diactins

and not parts of prostal pentactins, is a point which needs corroboration. Hexasters do not occur in the layer except in parts close to the junction with the tube-wall.

The above feltwork of spicular rays constitutes the support of the entire thickness of the external covering layer. I am inclined to think that all the spicules involved in its formation are direct derivatives from the dermal pentactins of the oscular wall-edge, i. e., of the parts whence the covering layer has grown out as lateral membraneous expansions. As before indicated, the layer, with its supporting spicules and a network of soft trabeculae, is to be looked upon as extensions of the most superficial parts of the dermatosome.

In a similar light is to be viewed the thin, cribrate, diaphragm-like partition, which I have mentioned before as sporadically occurring in the course of the canals, both gastral and intercanal. As principal supports of those partitions, there occur: long fiber-like needles, the same as the prostal needles to be soon described (not diactins but overgrown shafts of pentactins); stauractins, in which the atrophied rays are represented by swellings at the centre, the other rays appearing like the tangentials of either dermalia or gastralia; and similar-rayed pentactins, in which the unpaired ray stands vertical to the plane of partition and is more or less reduced in length. Neither hexasters nor the chambers are present in the membraneous partition. I assume that the first step in the formation of the partition in question consists in the protrusion into canal lumen of the spicules lining the wall surface, carrying with them parts of soft trabeculae of the dermatosome or the gastrosome, as the case may be.

The fine prostal needles, which occur in certain parts of the sponge, but especially on the oscular margin of certain parietal tubes, are long, straight or nearly straight spicules, without doubt the same as the "acerate" spicules which were made known by Bowerbank and Carter from *A. grayi grayi*. With regard to those spicules it was the opinion of F. E. Schulze (Chall. Rep., p. 360), perfectly correct I believe, that they are not free oxydiactine parenchymalia, but the very much elongated proximal radial rays of pentactine dermalia. In the Siboga specimens, the needles in question are of very various dimensions. While a small one measures only 2 mm. $\times$ 8 μ or less in length, a large one may be over 6 mm. long and 30 μ thick in the middle parts. Usually they gradually taper towards both ends. For the greater part of the length, they lie imbedded in the wall of the parietal tube. As ascertained in longitudinal sections through the wall of the oscular end of a growing parietal tube, the spicules run lengthwise in greatest number on the gastral side of the dictyonal layer, and in less number right through this as well as on the dermal side, distally projecting to a variable extent out of the surface of the marginal region. The weaker spicules are usually rough or uneven on surface, while the stronger ones are nearly smooth or but very faintly rough. Whenever and wherever circumstances permit, the needles are observed to terminate proximally with attenuated and simple natural ends; whereas, the protruded distal ends are found generally broken off. Not infrequently, however, there occur among the weaker needles such as still preserve the distal parts in the original state, in that they show at that end four cruciately disposed rays, thus revealing themselves to be pentactins with greatly prolonged unpaired ray or shaft. One of the largest I have discovered of such prostal pentactins had the shaft 2.5 mm. long and fully 10 μ thick in the middle parts, whence the thickness very gradually decreased both ways. At the point of its junction with the cruciate paratangentials, the shaft showed a thickness of not more than 6 μ. The paratangentials were

about 200 μ long. A knob was present in place of the atrophied distal ray. Now, similar pentactins form the dermalia of the region, and from the varying degree of protrusion shown by uninjured prostal pentactins, there can be but little doubt of these being nothing else than protruded dermalia. As regards the stronger prostal needles which are found invariably broken off at the outer end, there exists neither an annular swelling in their middle nor a central cross of the axial thread in indication of their diactine nature. On the other hand, needles of intermediate dimensions bridge them over to the shafts of manifestly pentactine prostals. So that, there seems to be no ground whatever for denying the shaft nature of even the longest and strongest prostal needles. I assume that all the prostal needles under consideration represent the rooting shafts of pentactine prostalia derived from dermalia and that these shafts continue to grow considerably in both length and thickness, even after the breaking off of the spicular centre together with the paired rays.

At the points of attachment of the sponge to foreign objects, there is developed a compactly textured mass or irregular plate, the usual basidictyonal structure, which internally stands in fusion with the dictyonal framework of the part. The structure is made up of sparsely microtubercled siliceous beams, inclosing small roundish or oval meshes of various sizes under 60 μ diameter.

Finally, as regards the hexasters, all the three kinds known to exist in *A. zitteli zitteli* are represented.

1. The lophodiscohexaster is, in all the specimens from Stat. 289 (Timor Sea), of fairly common occurrence on the gastral side of the tube wall, but is not a conspicuous object on account of its smallness and the delicacy of its parts. Diameter 35—57 μ, commonly about 50 μ, which is a size very considerably smaller than that of the same spicule in *A. zitteli zitteli* (diameter 100—153 μ). Principals obsoletely rough on surface, about as long as, or slightly shorter than, the tuft of terminals. Terminal tuft bell-like in shape and somewhat broader than long (fig. 6); sometimes more elongate and longer than broad (fig. 7); slightly expanded at the rim, not quite so conically shaped as in the typical species. Single terminals slender, ending with minute knob; numbering over ten and often nearly twenty in each tuft. — Attention was already called to the fact that the lophodiscohexaster was observed but very rarely in the specimens from Stat. 260 (Great Kei I.).

2. The spherical discohexaster (fig. 4), which in *A. zitteli zitteli* should be very rare, is here rather common, anyway not quite rare, especially on the gastral side and near the junction of the tube wall with the external covering layer, though nowhere present in any abundance. In both size and general appearance, the rosette seems to compare well with the same of *A. grayi grayi*, *A. grayi polae* and *A. zitteli zitteli*. Diameter 54—60 μ, exceptionally 70 μ, in one specimen; in another 54—68 μ. Each short principal bears five or six, moderately strong divergent terminals, which are nearly smooth or faintly rough on surface and terminate each with a watch glass-like disc provided with 6, 8 or more marginal teeth. In certain rosettes (fig. 5) of the category the terminals are very slender and number 3 or 4 — possibly sometimes 5 — to each principal. In still others, they are of a medium degree of slenderness.

3. The graphiocome (fig. 8) is again of a moderately common occurrence on both the dermal and gastral sides of the wall. The principals are very thin and measure not more than 7.5 μ in axial length; they show no distinct capitation at the outer end and are, as a whole,

quite inconspicuous. The terminals are, as in other forms of the genus, fine rhaphides which are seldom nearly straight, but more often slightly bent or gently wavy. About a dozen of them belong to each principal, forming a tuft which somewhat diverges outwardly, unlike the compact and uniformly broad rhaphidial sheaves of Euplectellid graphiocome. The tufts may be 75 μ long; frequently they are much shorter, the variation in length standing doubtless in relation to different developmental stages of the spicule. It is but seldom that one meets with the graphiocome in a good state of preservation. Far more commonly it is found in a broken up condition, in that the rhaphides have fallen off from the principals, — a process which I take for normal, since the rhaphides seem to be something that is destined to be shifted over, singly or otherwise, to the most superficial positions of the sponge wall. In stained preparations, there are not uncommonly observed, in connection with a broken up graphiocome, a membranous sac which partially contains the disjointed rhaphides, forming an irregularly radiating group. The rhaphides stick out of the sac with their outer parts, while within it there may be discernible the small sexradiate cross of the principals that originally bore them. The sac is apparently identical with the "capsule" which surrounds a developing hexaster (Ij. Contrib. I., p. 196).

Family Diapleuridae n. fam.

Genus **Diapleura** n. g. [1]).

1. *Diapleura maasi* n. g., n. sp. (Pl. XXVI, figs. 17—20).

Stat. 251. 5° 28'.4 S., 132° 0'.2 E. 204 m. 12 specimens.
Stat. 259. 5° 29'.2 S., 132° 52'.5 E. 487 m. 1 specimen and fragments.

Diagnosis. — Conical, attached by basal disc at the narrower end; calyciform, with thick wall and deep central gastral cavity. External surface jagged, showing numerous pit-like apertures mostly about 1 mm. or less wide, which tend to be arranged in longitudinal series. Internal surface relatively even, perforated by numerous, rather uniformly distributed, roundish apertures not more than 1.5 mm. in diameter. Wall consisting of irregular trabecula-like septa and pervaded by an intercommunicating (diarhysial) system of canal spaces. Dictyonal framework with beams and lantern-buttresses showing tubercled and rather broad transverse ridges on surface; spikes abortively small or suppressed. Loose spicules unknown.

Description. — Twelve specimens of this new species were obtained in one haul of the trawl at Station 251, S. of Kur I. Also Stat. 259 (W. of Great Kei I.) yielded a specimen and some fragments of the same species. Unfortunately, all the specimens are water-washed ones, being entirely deprived of the soft parts and loose spicules.

In general appearance the sponge closely resembles O. Schmidt's *Scleroplegma conicum* figured in 1880, (Taf. VIII, Fig. 4). The body represents a thick-walled calyx of an inverted conical shape (pl. XXVI, figs. 17—19). The size is small, being not more than 33 mm. in height and 24 mm. in greatest breadth. Inferiorly the body narrows to 10 mm. or thereabout, and again expands into a compact looking basal disc for attachment. As in *A. grayi polae*, but unlike other known forms of the genus, there is a deep-going central gastral cavity of

1) Unfortunately a definition of the genus is missing in the manuscript of the late Prof. I. Ijima. M. W.

circular cross-section occupying the axial part, opening above by the large osculum. The external surface is uneven, being of a decidedly jagged appearance (pl. XXVI, fig. 17). There open numerous small pit-like apertures, mostly 1 mm. and under in width and roundish or somewhat irregular in outline. Sometimes two or more of them in longitudinal succession open in unusually close approximation, or into an irregular groove-like depression of the surface. On the whole, the apertures show a tendency towards an arrangement in longitudinal series, the result being that there are observable on the surface inter-apertural ridge-like tracts of skeleton running likewise longitudinally. The tracts are of very irregular appearance and width, generally not more than 1.5 mm. wide in the widest parts. They are seen to divide into two at places in their upward course. — The internal (gastral) surface of the sponge wall is relatively even (pl. XXVI, fig. 19). It is perforated by a number of roundish, evidently aporhysial apertures 1.5 mm. or less in diameter and separated from one another by intervals seldom as wide as, but generally much less wide than, the apertures themselves. — In the thickness of the sponge wall, as seen in transverse section (pl. XXVI, fig. 18), there are, directly around the central gastral cavity, a distinct gastral wall of skeleton, about 1 mm. or thereabout in thickness and perforated by the above mentioned aporhysial apertures, and outside of this wall, a number of irregular, radially arranged, septum-like skeletal parts which are sometimes seen to divide as they proceed outwards, and between which there exist canal spaces likewise irregular and disposed more or less radially. Both the septum-like parts and canal spaces appear to be in most places about 1 mm. wide, but the width is very irregular. Moreover, the latter frequently appear interrupted in their radial continuity by the occurrence of thicker or thinner interseptal skeletal connections. — In longitudinal sectional views of the calyx wall (pl. XXVI, fig. 19, left side), the parts of skeleton, spoken of above as septum-like, present themselves, by no means as a continuous sheet, but as irregular cancelli-like strips of skeleton showing a number of gaps or perforations. These perforations and the skeletal strips between are respectively about as wide or thin as the corresponding parts that we have seen in transverse section. — It is now plain that the skeleton of this species consists, outside the gastral skeletal layer, of a complex of irregularly branching and anastomosing, trabecula-like dictyonal structures, which may perhaps most appropriately be called the septal trabeculae. These are at places thin and pillar-like; at other places thicker, up to about 1 mm. across. At no place do they seem to be regularly flat and plate-like for any great extent.

The intraparietal spaces between and among the septal trabeculae make up one continuous system of intercommunicating canal spaces that extends throughout the entire calyx wall. Of this fact I have convinced myself by repeated examinations of the specimens. The canal system communicates with the outer world by the apertures on the external surface and with the gastral cavity by those in the gastral skeletal layer. The most peripheral parts of the system probably serve for the ingress of water and the subgastral parts for the egress, but for the rest of it no sharp distinction is possible between the incurrent and excurrent parts, i. e. between the parts that represent the intercanals and the tube lumen. The above refers of course to the specimens in the macerated state, in which no clue exists for determining the prosopylic and apopylic sides of septal trabeculae. The incurrent and excurrent canals in *Diapleura maasi* are evidently in the diarhysial state, analogous to that which obtains in certain Tretodictyide, as e. g. in

Hexactinella. For explanation of that state of things in the present species, the most plausible assumption seems to be that the excurrent tube lumen and the incurrent intercanals, such as exist distinctly separate in other species of the genus, stand here in free intercommunication with each other, owing to the formation of gaps in the tube wall.

Spiculation. — The septal and gastral trabeculae of the skeleton are made up in most parts of 2 or 3 lychniscs lying side by side or in superposition one above another (pl. XXVI, fig. 20). In certain parts the meshes are fairly regularly rectangular, measuring about $^1/_3$ mm. by 0.5 mm. in dimensions, in most other parts they are occasionally triangular and commonly more or less irregularly shaped, owing to the unequal or asymmetrical development of the lychniscs or the irregular disposition of these in relation to one another. Thus, the sides are frequently of markedly unequal lengths, varying from 0.25 mm. to 0.5 mm.; the beams are sometimes bent in their course or start out from lantern-knots at various angles; not seldom a beam originating from a lantern-knot ends by joining, not a second lantern-knot, but a point in the course of another beam, forming with this an oblique angle. At times a beam may insert its one end even on a buttress of a lantern-knot, instead of coming in relation with any of the six beams arising from this in the usual way. Freely ending rays (spikes) which project outwardly from lantern-knots, superficially situated in any part of the skeleton, are commonly abortively developed, being represented by inconspicuously short and slender spines, or are entirely suppressed, in which case there remain in their stead only the outwardly directed pyramids of the octahedral lantern-knots. Sometimes two such free unspiked pyramids may occur to a lantern-knot, the remaining four pyramids being continued each into a well developed dictyonal beam.

The dictyonal beams (pl. XXVI, fig. 20) are ordinarily 50—90 μ thick; the parts within lantern-knot are much thinner, being less than 20 μ thick. Lantern-knots measure 140—200 μ across between two opposite buttresses. They are not always quite regularly octahedral in relation to the spicular rays forming varying angles with one another at the spicular center. The buttresses are strongly developed, being 30—40 μ thick in their middle. The spaces between them and the spicular center are small and appear as oval or roundish spaces of 30—50 μ diameter. Both the dictyonal beams and the buttresses are provided on the surface with a number of transverse ridge-like or pad-like prominences beset with tubercles. The tubercled prominences which may be 50 μ long and often as broad as 15 μ, form a conspicuous feature of the skeleton. Rarely the tubercles are found isolated or arranged in simple transverse rows.

In certain parts of the skeleton there occur small simple hexactins without the lantern formation, standing in ankylosis with the beams. These are evidently spicules of a special nature which have attached themselves to the framework at a comparatively late period of their existence, and are not to be taken for inceptional lychniscs. Their rays are of an irregular tuberculate-like contour, due to irregularities in the secondary deposit of siliceous matter on the surface. The hexactins occur usually isolated, but are sometimes found congregated in large numbers and joined together, forming irrregularly reticulate masses of no definite shape or size. The masses may be discerned as whitish spots under the hand-lens, and are probably the same as the reticulate spheres or nests which were described by Weltner (1882, p. 17). They appear not unlike the basidictyonal mass of young broods known from *Staurocalyptus mirabilis* F. E. Schulze (1899 *a*, pl. XVI, figs. 2—6) and *S. glaber* Ijima (1904, pl. XV, fig. 13).

The compact basal disc for attachment I have found to be made up mainly of a dense crowd of small simple hexactins identical with the above described, which are joined together in a very irregular manner. The ultimate contact surface with the substratum is lined with a thin irregular layer of a small-meshed siliceous reticulum, the basidictyonal plate. This and the fused hexactins together constitute the basidictyonal mass of essentially the same characterization as that found in all *Lyoplectosa* attached by base to the hard substratum.

As before mentioned, unfortunately none of the specimens have preserved loose spicules. The species is named in honour of Prof. Otto Maas of Munich.

Remarks. — The species agrees with *A. grayi polae* in exhibiting a distinct central gastral cavity, but differs from it markedly in the character of the canals in the calyx wall. In that species there exist wider and tubular parietal tubes distinct from the intercanals; and as regards the spiculation, the dictyonal meshwork is more regularly checker-like, the spikes on superficially situated lantern-knots are well developed, and the beams and lantern buttresses exhibit on surface isolated tubercles which are only here and there united into incomplete transverse rows.

In the absence of observations on its loose spicules, the species cannot be said to stand on a secure basis with respect to its exact position in the family.

Indeterminable Lychniscosa.

? *Aulocystis* sp. (Plate XXVI, figs. 22—24).

Stat. 97. 5°48′.7 N., 119°49′.6 E. 564 m. 1 fragment.

The single small fragment (pl. XXVI, figs. 22, 23) — and that, unfortunately a completely water-washed one, — obtained at Stat. 97, near Pearl Bank, Sulu Is., appears to represent an Aulocystid form which cannot be identified with any of the surely known species. It is a slightly curved plate, one end of which is apparently a part of the natural oscular edge. Judging from the curvature of the piece, this must have originally formed a part of a tubular sponge wall 10 mm. or thereabout in diameter.

The concave — and therefore presumably the gastral — surface of the fragment is fairly even (fig. 23), while the other (dermal) surface, except along the oscular margin, presents a rough appearance owing to the presence of low irregular prominences, in part tubercular and in part somewhat ledge-like. The appearance is not unlike that of certain parts of the exterior of a young *Euplectella imperialis* (fig. 22). The prominences may be about 2 mm. high and up to nearly 1 mm. thick. The sponge wall is 0.5—1 mm. (on an average, say 0.75 mm.) thick, the prominences not being taken into account.

A few, small, ill-defined and insignificant gaps are seen to perforate the wall. On the inner side of the wall, the gastral surface is sometimes slightly depressed around the gaps; and on the outer side, some of the gaps are seen to be partially surrounded by the external ledge, or to be so situated in relation to the latter that there is brought about an appearance of small radial parietal tubes in quite rudimentary development. In parts of the sponge farther removed from the oscular margin than those represented in the fragment, the gaps may possibly be larger and the radial parietal tubes more manifestly developed.

The above indicated macroscopic feature of the wall sufficiently differentiates the sponge

from all known Aulocystids. The dictyonal skeleton (pl. XXVI, fig. 24) also seems to present peculiarities, especially in regard to the superficial tuberculation of the beams and nodal buttresses. The tubercles are small and conically pointed. They are arranged in transverse, shorter or longer, usually single-file rows, which on the beam proper are scarcely raised in a continuous ridge-like way, but on the buttresses take the form of low ridges toothed on the crest. On the more robustly developed lantern knots, the ridges may be broadened into pad-like swellings with a crowd of tubercles on the convex surface, somewhat as in *Diapleura maasi*.

Lychniscs occur in three or more tiers in the thickness of the wall. The lantern-knots are somewhat more robustly developed in the deeper parts of the wall than in the peripheral or in the external prominences. Deeply situated lantern-knots 134—195 μ broad (between external contour-lines opposite buttresses), with buttresses up to 45 μ thick; more peripherally situated lantern-knots 123—155 μ broad. Lantern-knots most superficially situated on both dermal and gastral surfaces show each a freely outstanding ray, which is straight, slenderly spine-like and rough all over. Dictyonal meshes generally 250—360 μ in length of sides (as measured between centres of two adjoining lantern-knots); on the gastral surfaces they are fairly rectangular or quadratic in shape, with bounding beams 46—62 μ thick; peripherally and in the external prominences they are irregular, with beams sometimes as thin as 25 μ.

? *Aulocystis* sp. (Plate XXVI, fig. 25).

Stat. 306. 8° 27′ S., 122° 54′.5 E. 247 m.

A small completely washed-out fragment (pl. XXVI, fig. 25) from Stat. 306 (Lobetobi Strait, E. end of Flores). It represents an irregular wall plate of about 1 mm. thickness, showing roundish convexities on one side which is presumably the dermal. On the other side there are concavities corresponding to the convexities of the external side. The piece must have formed a part of a saccular or tubular sponge with irregular outbulgings on the sides. There exists on the piece certain indications of the sponge having in part formed anastomosing tubes of considerable width.

The firm skeleton presents on both sides in part a densely granulated and finely porous appearance; in other parts it shows a regularly tessellate, finely meshed structure. In the latter parts, the pore-like meshes generally measure 174—266 μ across; the beams between lantern-knots 47—92 μ thick; the lantern-knots 140—174 μ across from side to side. The eight openings on the surfaces of the knot are frequently small and indistinct. The buttresses and the beams are provided on the surface with low transverse bosses or ridges showing a series of tubercles on the crest, in nearly exactly the same way as in *D. maasi*. At places of both surfaces, where the structure is of a rather granulated than tessellate appearance, there is a secondary coalescence of much lychniscs in irregular orientation. In such places the lantern-knots may be unusually small and may not infrequently be represented even by simple, somewhat swollen nodes of spicular center without buttress formations.

On the whole the characterization of lychniscs and of the dictyonal beams comes most closely to that of *D. maasi*. But then the general habitus of the sponge is apparently quite different from that species.

Tribe C. LYSSACINOSA n. tr.

Lyssacina partim, ZITTEL, 1877. — F. E. S., 1886, p, 36; F. E. S., 1887.
Lyssacina, IJIMA, 1903, p. 25, footnote.
Hexasterophora, SCHRAMMEN, 1902. — TOPSENT, 1904*b*.

Hexasterophora with choanosomal megascleric holactins, varying in number of rays but always comprising the rhabdodiactin amongst them, if not consisting exclusively of it. The megascleres primarily and commonly all free (lyssacine), but sometimes connected together by fusion to a greater or less extent.

The tribe includes sponges of various shape, but commonly cup-like, vasiform or tubular and with either broad or stalk-like inferior parts. The body but seldom forms a branched stock. It is scarcely ever developed in a lamellar shape. It grows either firmly fixed to the hard substratum by an attachment disc or rooted in the loose bottom by means of basal anchoring needles and rarely of finger-like processes from the base of body (*Schaudinnia*, *Trichasterina*). Lophophytous forms occur in the Leucopsacasidae (*Placopegma solutum*) and the Euplectellidae, in both which families the rooting fibres are either monactins or anisoactine rhabdodiactins, apparently derived from choanosomal megascleres; and frequently also in the Rossellidae (*Melonympha*, *Lophocalyx*, *Rossella*, *Aulorossella*, *Gymnorossella*, etc.) in which the rooting fibres are invariably specially modified pentactins which are probably adaptations of pentactine hypodermalia.

The outstanding distinctive character of the Lyssacinosa with respect to their choanosomal supporting megascleres has already been dealt with, and need not be gone into again. Suffice it to recall that they always include amongst them, or are chiefly or even entirely, rhabdodiactins which in most cases are those probably directly derived from the hexactin by suppression of four rays in two axes; and that the rigidly fused state of the spicules observed in certain Lyssacinosa, commencing at the basal end of body and extending superiorly to various extent in different forms, is to be regarded as being a relatively late acquisition and genetically independent from that which characterizes the dictyonal skeleton of the Hexactinosa or of the Lychniscosa.

Ectosomal skeleton consists of a layer of the dermalia, either alone as in the other tribes or supplemented by an underlying layer of hypodermalia. The former is the case with the Leucopsacasidae and the Euplectellidae, the dermalia being either moderately large pentactins or hexactins with prolonged proximal ray which penetrates the choanosome like a nail and so fixes the dermal layer in its place. Hypodermalia constantly occur in the Caulophacidae and the Rossellidae. Here the dermalia are usually small spicules which do not stand in direct relation to the underlying choanosome but form a delicate covering layer supported by, as well as connected to it by means of the hypodermalia. These are either large pentactins with the unpaired ray dipping into the choanosome or rhabdodiactins arranged in bundles, or both together. The uncinate has never been observed in the Lyssacinosa.

Differential key to families of the Lyssacinosa.

A. Ectosomal skeleton of dermalia only; without differentiation of hypodermalia.
   a^1. Dermalia are moderately large pentactins . . . . . Leucopsacasidae Ij.
   b^1. Dermalia are hexactins, as a rule with prolonged proximal ray . Euplectellidae Ij.

B. Ectosomal skeleton of a layer of small rough dermalia supported by hypodermalia, which are either pentactins or rhabdodiactins, or both together.
   c^1. Dermalia are hexactins or pentactins with distinctly pinulately developed distal ray. Sponge-body goblet-like or mushroom-like . Caulophacidae Ij.
   d^1. Dermalia are generally pentactins with unpaired ray directed proximad, stauractins or rhabdodiactins; rarely hexactins or pentactins with distal ray which is however never distinctly pinulately developed. Sponge-body sacciform . . . . . Rossellidae F. E. S.

Family Leucopsacasidae [1]) Ijima, 1903.

Leucopsacinae, Ijima, 1898, p. 41.
Leucopsacidae, Ijima, 1903, pp. 29, 110. — F. E. Sch., 1904, p. 175.

Lyssacinosa of thick-walled, cup-like or ovoid body, sometimes stalked, firmly attached by base rooted by anchorate basalia. Ectosomal skeleton generally of relatively large pentactine dermalia with the unpaired ray directed proximad; without differentiation of hypodermalia. Choanosomal megascleres of hexactins and rhabdodiactins, the former being in greater evidence than the latter. (The same spicules sometimes of rhabdodiactins only?). Hexaster represented by a form or certain forms of discohexaster, in addition to which a sigmatocome (or a plumicome?) may occur; without oxyhexaster.

With five genera: *Leucopsacas* Ij., 1898; *Chaunoplectella* Ij., 1896; *Placopegma* F. E. Sch., 1895; *Caulocalyx* F. E. Sch., 1886; *Chaunangium* F. E. Sch., 1904. The last two provisionally placed in the family. For a key to the genera, see F. E. Schulze, 1904, p. 175.

In the "Siboga" collection are represented *Leucopsacas scoliodocus* Ij. and a new species of *Chaunoplectella* (*C. stelleta*).

Genus **Leucopsacas** Ijima, 1903.

Leucopsacus Ijima 1898, p. 42; 1903, p. 34, 110.

Leucopsacids with small, ovoid or spindle-like body, which may be stalked. Parenchymalia

1) The genus, which gives name to this family, should properly be called *Leucopsacas* (λευκός + ψακάς) — not *Leucopsacus* as was originally put forth by me in 1898. Hence the change of Leucopsacidae into Leucopsacasidae.

chiefly hexactins; diactinic parenchymalia present, but play a subordinate part. Gastralia represented by hexactins similar to those of the parenchyma. Discohexasters in part hexactinose and in part hexasterous.

Key to species of *Leucopsacas*.

A. Hexasterous discohexaster with terminals in a distinct group to each principal . . . . . *Leucop. orthodocus* Ijima.

B. Hexasterous discohexaster generally spherical in shape.

a^1. Parenchymal hexactin with rays somewhat bent. Body not stalked . . . . . *Leucop. scoliodocus* Ijima.

b^1. Parenchymal hexactin with much curved rays. Body with short stalk . . . . . *Leucop. scoliod. retroscissa* Topsent.

1. *Leucopsacas scoliodocus* Ij., 1903. (Plate IX, fig. 19).

Leucopsacus scoliodocus Ijima, 1898, p. 43; Ijima 1903, pp. 46—52, 110; pl. III, figs. 27—37.

Stat. 251. 5° 28′.4 S., 132° 0′.2 E. 204 m. One specimen.
Stat. 289. 9° 0′.3 S., 126° 24′.5 E. 112 m. One specimen.

Diagnosis. — Fusiform, ovoid or globular, moderately thick-walled cup of small size. Parenchymal hexactins with curved sinuous rays. Hexactinoid discohexaster 100—180 μ or 90—153 μ or 76—122 μ in axial length, with terminal anchor-teeth simply or slightly flexuously recurved, usually 3 or 4 in a whorl. Holodiscohexaster spherical, 46—70 μ or 60—80 μ or 34—51 μ in diameter. Small floricome-like hexaster (either tylofloricome or sigmatocome) present or absent.

Description. — Of the two Siboga specimens which I refer to *L. scoliodocus*, the one from Stat. 251 (S. of Kur I., among Kei Islands) is complete and has body of an ovoid shape; it was torn off at the lower end. Height not less than 12 mm.; greatest breadth about 7 mm.; wall 2—2.5 mm. thick in the thickest parts; osculum at the upper rounded end about 2 mm. or over in diameter. In general appearance, structure and spiculation, the specimen is quite like those which I have described from Sagami Sea. Of the spicules the following points were determined.

Dermal oxypentactins of varying size, with tangential rays straight or nearly straight, up to 0.75 mm. in length and about 15 μ in thickness at base. Parenchymal oxyhexactins likewise of various sizes, frequently with rays of unequal length in the same spicule; rays usually somewhat flexuously bent, up to 1 mm. and over — in certain cases, even 2.5 mm. — in length with basal thickness of nearly 20 μ. Parenchymal diactins relatively sparsely present, long and slender. Bow-shaped oxydiactins of an unusually great strength — about 2 mm. long and 40 μ thick in the middle — were met with in small numbers; but these were possibly extrinsic spicules.

Hexactinoid discohexasters common, 90—153 μ in axial length; terminal anchorate umbel nearly hemispherical or bell-like in outline, often slightly flaring at rim, made up of 3 or 4 teeth which may nearly reach 12 μ in length.

Spherical holodiscohexasters numerous, 60—80 μ in diameter, of just the same character as in the Japanese specimens.

Floricome-like hexasters were met with in some numbers. Diameter 55—61 μ. They are therefore somewhat larger than in the Japanese specimens, in which the diameter measures only 38—50 μ. Another noteworthy fact is that, while in the latter the rosettes in question have terminals ending each with a minute pinhead-like swelling (tylofloricome), the same in the "Siboga" specimen are sigmatocomes, i. e., they have the thickened and outwardly bent, free end of terminals ending with conical tip. TOPSENT ('04) seems to have found the corresponding spicules in his *L. scol. retroscissa* to be likewise sigmatocomes. I am doubtful if the "Siboga" specimen should be systematically separated from the Japanese on account of the above difference.

The second specimen, i. e., the one from Stat. 289 (off to south of the eastern end of Timor), is a very small, and therefore probably quite a young, individual. It was found attached on a dead *Aulocystis zitteli sibogae*. Elongate and nearly club-like in shape, it measured about 8 mm. in length, and 2 mm. or over in breadth at the thicker rounded end, on top of which was situated a small osculum, less than 1 mm. in diameter. The narrower elongated parts were also rounded at the extremity, the point of attachment to the substratum lying on one side of the basal region. Under the lens the dermatosome was seen as a clear stratum over the opaque whitish choanosome occupying the axial parts. The tubular gastral cavity extended close to the lowest end. Sponge wall about 0.75 mm. thick in the thickest part. The entire specimen was made into slide preparations.

Spiculation. — The dermalia are exclusively oxypentactins of a moderately large size. They form with their tangential rays a lattice which is at places irregular-meshed and at other places more or less regularly quadrate-meshed. All the rays straight, faintly rough or nearly smooth, slender, tapering from base to the outer end which is mostly finely and sharply, sometimes obtusely, pointed. Their tangentials generally 150—250 μ long, up to 8 μ thick at base, the four cruciate rays forming a slightly convex plane on the outside. The proximally penetrating unpaired ray is longer than, often fully twice as long as, the tangential of the same spicule.

Regular oxyhexactins, similar to dermalia in dimensions (rays generally 120—225 μ long) and characters, constitute the main parenchymalia. Commonly they are arranged in a single layer in the sponge wall, with one axis always radially directed and with the distal ray in that axis standing in relation with the proximal ray of dermalia. Only occasionally two or three parenchymal oxyhexactins are seen to be placed one upon another in a radial line. All the rays are straight as a rule. The paratangential rays of the spicules in question form, by interrelation of those belonging to different spicules, a mesh-work layer situated about midway between, and parallel to, the dermal and gastral surfaces. As a general matter, each mesh of that layer seems to contain a radially oriented and irregularly thimble-shaped flagellated chamber; so that the oxyhexactins are for their greater part situated between and on the external side of the chambers which are arranged side by side in a simple (not folded) layer.

Long and thin (not over 8 μ thick) parenchymal diactins are found in sparse number. They run singly or in weak bundles and seem to be confined in their occurrence to subgastral positions, inside the chamber layer. An annular swelling marks the centre of the diactins.

Regularly shaped oxyhexactine gastralia line the gastral cavity in an irregular layer. Rays minutely rough, usually 100—130 μ long and scarcely 4 μ thick at base. The spicules are considerably smaller than average parenchymal oxyhexactins.

Of intermediary rosettes, there are present the usual hexactinoid discohexaster and the spherical holodiscohexaster, both occurring not uncommonly in the dermatosome. The former measures 76—122 μ in axial length; the anchorate umbel commonly nearly semi-oval in shape, made up of 3 (very seldom 4) claws. These may be 10 μ long; sometimes perceptibly bent outwards toward the free end.

The spherical holodiscohexaster which is the commoner of the two rosette-forms, is exactly like that of the typical species (Ijima, contrib. III, pl. III, fig. 32). Diameter 51—34 μ; rarely as small as 23 μ. Each short principal bears 5 or more, moderately strong terminals, each ending with a small disc with six or more marginal teeth.

No tylofloricome was discovered.

Genus **Chaunoplectella** Ijima, 1903.

Chaunoplectella Ijima, 1896, p. 250; 1898, p. 43; 1903, p. 53, p. 111.

Leucopsacids with moderately large, ovoid or vase-like and thickwalled body, attached by short stalk-like base. Parenchymalia chiefly hexactins and diactins. Dermalia either all pentactinic or with a variable number of rays, none of which however are distally outstanding. Gastralia represented by hexactins similar to those of the parenchyma. Discohexasters always hexasterous, the larger ones with terminal prongs arranged in a whorl-like anchor-teeth; with or without sigmatocome in addition.

Key to species of *Chaunoplectella*.

A. Sigmatocomes present on tip of outstanding ray of canalaria . . . *Chaunoplectella cavernosa* Ij.
B. Sigmatocomes not found.
  a^1. Discohexaster commonly 60—76 μ in diameter, not larger than 86 μ . . . . . *Chaunoplectella stelleta* Ij.
  b^1. Discohexaster may be as large as 114 μ in diameter . . *Chaunoplectella spinifera* Ij.

1. *Chaunoplectella stelleta* n. sp. (plate IX, figs. 6—9).

Stat. 59. 10° 22′.7 S., 123° 16′.5 E. 390 m. One specimen.

Diagnosis. — Pouch-like, thick-walled, contracted below; external surface differentiated into front and back, demarkated by angular edge line. The former covered with open-meshed and the latter with dense-looking dermal layer. Osculum opening in the upper part of back. Megascleric parenchymalia oxyhexactins of varying size and often with bent rays with some diactins in addition. Dermalia moderately large and regular oxypentactins, which under circumstances may have the paratangentials thickly beset with short hair-like processes. Hexasters consist of spherical discohexasters only; diameter 45—80 μ (mostly 60—76 μ); principals very short, each with 2—4, thin and long terminals ending with minute 5- or 6-pronged terminal disc.

Description. — The single, small and probably not yet fullgrown specimen (fig. 9) on which this new species is based, was obtained at Station 59 at the western entrance of Samau Strait, Timor. The shape may be compared to that of a pear, the narrowed end representing the base, where the sponge had been torn off; but the body is so laterally compressed that it presents two surfaces, differently characterized and the one more convex than the other, somewhat like the belly and back of one's thumb end. The two surfaces are demarkated from each other by an angular edge line. The more convex surface bears, on the top of its rounded convexity, a small osculum (fig. 9, right). Height of the entire sponge 14 mm.; greatest breadth 12 mm.; greatest thickness as measured between the two surfaces 8 mm.

The entire sponge is devoid of a prostal armature. The osculum-bearing surface is closely textured and almost compact-looking, nearly completely concealing the canal apertures that open beneath the dermal layer; whereas, the opposite, less convex surface (fig. 9, left) plainly shows a number of variously sized canal apertures under 1 mm. diameter, some of which apertures are covered up by a very delicate dermal lattice with open irregular meshes enclosed by extremely thin beams. The lattice looks very much like the dermal layer of *Ch. cavernosa*. On this side of the sponge, a number of small parenchymal bundles are seen to arise in the upper parts and to converge towards the torn off basal end. The fact, that some of the canal apertures on this side open freely, is, I believe, simply due to the falling away of the covering lattice that was originally present. Under this supposition all the canals that open, on this side, as also all those that open subdermally on the other, are to be considered as incurrent.

Apparently here recurs that condition of sponge body which I have pointed out for *Bolosoma paradictyum* Ijima (1903, p. 9) and in which the external (dermal) surface is differentiated, probably in relation to certain physical conditions of the habitat, into two opposite parts which may be called the front and the back, the former being more especially adapted to the passing in of the water than the latter. In order to keep up the analogy to that species, the open-meshed and the less convex surface of the present specimen should be called the front and the more convex, osculum-bearing side the back.

The sharp-edged osculum, only about 2 mm. wide, leads into a small and irregular-shaped gastral cavity, formed by the confluence of excurrent canals. A continuous gastral lattice does not exist. The sponge wall is very thick.

Spiculation. — The megascleric parenchymalia (fig. 10) are chiefly oxyhexactins, in addition to which there occur some diactins in certain parts. The former are of very various sizes, fluctuating between those in which the rays are 200 μ or thereabout in length and only about 6 μ in thickness at base and those large ones with rays which may be 2 mm. or over in length and nearly 40 μ — sometimes even 50 μ — in thickness at base. The oxyhexactins, especially the stronger ones, are frequently of an irregular shape, in that the rays may be of unequal lengths or are bent in a greater or less degree. Those of the oxyhexactins which are situated near the dermal or the gastral surface have the ray directed toward the respective surfaces very much shorter than their fellows of the same spicule, the whole thus becoming elongate conical in shape. As a general matter, the rays are sharply pointed at end and subterminally quite or nearly smooth. In those rays which are greatly prolonged the tapering is very gradual, often so gradual as to show nearly the same breadth for a considerable part of their

length, as in a long diactin. Excepting the subdermally and subgastrally situated oxyhexactins in which one of the axes is radially directed, there seems to exist no definite rule as to the direction taken by spicular rays or the relative disposition of separate spicules. Slender and filament-like diactins occur sparsely in the general parenchyma but numerously in the fibrous bundles that traverse the parenchyma towards the basal end of the sponge. These bundles are composed of not only long-rayed oxyhexactins, such as described above and which go into their formation by one of their axes, but also of long and slender diactins which may be 4 mm. long or longer and are under 20 μ in thickness. The slender diactins taken from the basal parts usually have the lower thicker end rounded and thickly beset with conical microtubercles, while their upper parts are thinly and filamentously drawn out to terminate with an acutely or bluntly pointed tip which is smooth or at any rate much less pronouncedly rough than the other end. The spicular center, externally indicated by a faintly marked annular swelling, is situated very much nearer to the thicker lower than to the attenuated upper end, often within only 0.25—0.50 mm. distance from the former. Similar unequal-rayed parenchymal diactins have been described and figured by me from the basal parts of *Rhabdocalyptus victor* Ijima (1904, p. 246). Without doubt we have here to do with diactins in which the growth in length stopped early in the lower ray but continued to take place in the upper, in relation to the upward growth of the sponge-body.

The dermal skeleton shows no differentiation into autodermalia and autogastralia, and consists of variously sized but on the whole moderately large orthopentactins with straight and rather strong looking rays which gradually taper out to a sharp or blunt point at end. Paratangentials in a large spicule 300 μ long, by 33 μ long, by 33 μ thickness at base. Same in a small one 145 μ long and 10 μ thick at base. The unpaired proximally directed ray may be about as long or nearly twice as long as the paratangential. In the majority of cases, all the rays are smooth throughout, though at times the ends may show at most only a very slight indication of roughness. Exception to this rule is offered by certain apparently old dermalia, which I have met with in some parts of the convex back surface of the sponge exterior. In these the paratangentials were thickly beset with hair-like minute processes, though the unpaired proximal ray was smooth as usual. The fine processes are set very close together in uniform distribution and generally stand out vertically from the surface, bringing about an appearance almost like that of a ciliary covering. On the back surface of the sponge the paratangential crosses, as seen in surface view, occur numerously and rather close together in quite irregular disposition, so that the rays of different crosses intersect one another at indefinite angles and do not form a regular-meshed lattice-work. At places, more than two crosses are seen to overlap one another with their rays but not always in direct contact, on which account they cannot be said to form a compact layer. Not that the more superficially situated crosses are always the larger, but the contrary is not infrequently the case. On the front surface of the sponge the dermalia were found in a sparse number in relation to the delicate nature of dermal beams on this side, but partly on account of loss by laceration.

On the gastral surface of the sponge I have found a number of thinrayed and regularly shaped oxyhexactins (sometimes oxypentactin or oxystauractin) with rays 152—190 μ long and 4 or 5 μ thick at base. Possibly the spicules, here referred to, are to be looked at in the light

of gastralia, though scarcely distinguishable in shape from the smaller parenchymalia found in the deeper parts.

The hexaster is represented by one form only, viz., spherical discohexaster (fig. 11). This occurs in moderate abundance in all parts except the dermal layer. In general appearance it agrees well with a form of rosettes found in both *Ch. cavernosa* and *Ch. spinifera* Ijima (1903, pl. V, fig. 14 and pl. VI, fig. 7), though much smaller in size. Diameter 45—84 μ, mostly 60—76 μ. Each very short principal bears 2—3, sometimes 4, divergent terminals, of which the total number in one spicule runs up to over 12 but generally stops under 20. They are long and slender, nearly uniformly thin, smooth or almost smooth and generally straight, except at origin from the principal. The convex terminal disc is very small, measuring not more than 4 μ across from end to end of marginal recurved prongs of which there are 5 or 6, rarely more.

Remark. — From the characters of this new species it is plain that this belongs to the Leucopsacasidae (Ijima, 1903, p. 33), and under that family to the genus *Chaunoplectella* (ibidem, p. 53). Of the two previously known species of the genus, the new species is evidently much more closely related to *Ch. spinifera* Ij. than to *Ch. cavernosa* Ijima.

Family Euplectellidae (Gray 1867.), Ijima, 1903.

Euplectelladea J. E. Gray, 1867, pp. 504, 527.
Euplectellidae F. E. Sch., 1886, p. 37; 1887, p. 51; 1896, p. 44; 1899*a*, p. 96; 1902, p. 46; 1904, p. 172. — Ijima, 1903, pp. 19, 108. — v. Lendenfeld, 1915, p. 20.

Lyssacinosa of tubular, cup-like or massive body, sometimes stalked; either rooted by a tuft of monactine or anisodiactine anchorate basalia or firmly attached by compact base; commonly with numerous open oscula. Ectosomal skeleton of relatively large hexactine dermalia, the proximal ray of which is as a rule much longer than any other in the same spicule; without hypodermalia. Choanosomal megascleres of hexactins with rays varying in number from six to two. Hexaster various.

Divided by Ijima (1903, pp. 26, 27) into two subfamilies, the Euplectellinae and the Corbitellinae.

Subfamily a. Euplectellinae Ijima, 1903.

Euplectellinae partim, F. E. Sch., 1886, p. 37; 1887, p. 52.
Holascina F. E. Sch., 1886, p. 39; 1887, p. 85; 1896, p. 44; 1899*a*, p. 97.
Euplectellinae F. E. Sch., 1896, p. 46; 1899*a*, p. 97.
Euplectellinae Ijima, 1903, p. 26. — F. E. Sch., 1904, p. 173.

Euplectellidae rooted in the loose substratum by a tuft of basal spicules.

At the time I last defined this subfamily (1903) there were known of it the three genera *Euplectella* Owen, *Holascus* F. E. Sch. and *Malacossacus* F. E. Sch. (for a key to which see F. E. Sch. 1904, p. 173). Since then, three more genera referable to the subfamily have been described, viz., *Docosaccus* by Topsent (1910, p. 8; 1913, p. 595), *Acoelocalyx* by Topsent (1910, p. 5; 1913, p. 592), and *Holascella* by v. Lendenfeld (1915, p. 29).

The "Siboga" collection contains an *Euplectella* species which seems to be new and will be called *E. timorensis*.

Genus **Euplectella** Owen, 1841.

Euplectella Owen, 1841, pp. 3—5. — Ijima, 1901, pp. 37—58; F. E. Sch., 1904, p. 132?

Thin walled tubular body, anchored in the substratum with a tuft of spicules at the lower end. Superior end having a sieve-plate which separates the so-called gastral cavity from the exterior. Lateral wall with round parietal oscula. Parenchymal principalia of the circular and longitudinal skeletal beams are stauractins, oxypentactins or oxyhexactins. Hexasters of three kinds: 1) floricome, 2) graphiocome, 3) either oxyhexaster or onycaster or oxydiaster, the last two occurring infrequently.

1. *Euplectella timorensis* n. sp. (Plate VII, figs. 1—7).

Stat. 284. 8°43′.1 S., 127°16′.7 E. 828 m. Five fragments (B—F).
Stat. 289. 9° 0′.3 S., 126°24′.5 E. 112 m. One fragment (G.)
Stat. 300. 10°48′.6 S., 123°23′.1 E. 918 m. One specimen (A).

Diagnosis. — Euplectella like *E. imperialis* Ijima and *E. regalis* F. E. Sch. With low, thin and irregular parietal ledges, the sharp edge of which is furnished with an inconspicuous palisade-like row of projecting spicular rays. Large stauractins constitute the principalia of skeletal framework. Megascleric elements of skeletal beams fused together only in the inferior parts of body. Oscularia are pentactins with elongate conical rays not shorter than 100 μ. Distal ray of dermalia showing a sparse number of obsolete microtubercles, nearly smooth; same of the larger dermalia on the edge of parietal ledges accompanied by smooth oxydiactin comitalia without central swelling.

Description. — There are in all seven specimens which I refer to the present species though not with an equal degree of certainty in every case. They will be called specimens A—G for the sake of reference. They come from three stations, all situated in the sea (Timor Sea) along the south coast of Timor Island.

Specimen A (pl. VII, fig. 1), the single specimen obtained at Station 300 (E. of Rotti Island at the western end of Timor), is a nearly complete one though lacking the sieve-plate and damaged in the upper parts as well as on the external surface. It is evidently a comparatively young individual. The tubular body is 160 mm. long exclusive of the basal bulb of mud and entangled anchoring spicules. It is slightly bent. At the upper end, where the diameter should have measured only about 16 mm., there is preserved a portion of the cuff. This is very narrow, measuring scarcely 1 mm. in width, and shows along the free margin an inconspicuous, palisade-like row of spicules. The body is broadest in the lower third of its length, in which

parts the wall is laterally compressed and the breadth of body reaches up to 33 mm. in one aspect of the specimen and to 25 mm. in the other. The entire body-wall is soft and pliable, although in the lowest parts fusion has set in to a limited extent among the spicules of skeletal beams. In the broadest part of the body the number of longitudinal skeletal beams amounts to at least 35; this number decreases to about 29 in the parts close to the lower body-end and increases to about 45 a short distance below the cuff. Strands of basalia shafts conspicuously seen in the lower third of the body. Of the circular skeletal beams there are approximately 80. The meshes formed by the above systems of beams are mostly nearly square, reaching up to 2.5 mm. in the length of sides. The oblique beams are feebly developed and inconspicuous. Parietal oscula up to 1 mm. or slightly over in diameter. The superficial flake-tissues had been subjected to much laceration; nevertheless, there still exist here and there in the middle parts of the body, remnants of parietal ledges in the form of small lappets of indefinite shape and not higher than 2 mm. These bear on their thin edge an irregular palisade-like row of projecting needles, which at times may stand out to a length of 2 mm. but are generally shorter. It may here be remarked that similar fringed ledges are observed also in both *E. imperialis* and *E. marshalli* under certain circumstances.

From Station 284 there are five fragmentary specimens, to be called B, C, D, E and F.

Specimen B (pl. VII, fig. 2) is a collapsed tubular fragment torn off evidently from somewhat below the middle of a moderately large individual, which may have measured a foot or thereabout in height. The fragment is 50—85 mm. long. At one end, which I consider to be the upper, the diameter may be estimated at about 45 mm., while the same at the other end is considerably less. The wall is relatively thin, being only about 1 mm. thick. The flake-tissue is badly soiled by mud and has been largely rubbed off from the external surface. However there still remain at places feeble indications of parietal ledges. Parietal oscula are numerous and small, mostly measuring under 1.50 mm. and rarely nearly 2 mm. in diameter. Adjacent longitudinal skeletal beams never more than 2 mm. apart. Transverse skeletal beams up to 3 mm. apart. Oblique beams very feebly developed. Nowhere in the specimen is the ankylosis of parenchymal megascleres observable.

Specimen C represents the upper parts of an individual presumably of about the same size as, or somewhat larger than specimen A. The piece, about 70 mm. long and torn at both ends, is much mutilated, but still shows some low and narrow ledges with an inconspicuous row of projecting needles on the edge. Stauractinic megascleres taken from the lower parts of the fragment are considerably larger than the same from the upper end of specimen B, — a fact which may be taken for an indication that the two pieces belonged to different individuals.

Specimen D is a small fragment of wall, which might have belonged to the same individual as specimen C.

Specimen E (pl. VII, fig. 3) is a large, tubular and slightly bent fragment of the skeletal framework, from which the flake-tissue had been nearly completely washed away and on which are attached a number of Hydrozoan colonies, worm-tubes, Ophiurans, etc. I should think the dead fragment originally formed the middle parts of an old individual, considerably over a foot in length. In the middle of the skeletal tube, where the diameter measures about 60 mm., there exist no less than 62 longitudinal beams. These are moderately strong, measuring not infrequently

nearly a millimeter, more often less, in thickness. The interspaces between them are of varying widths, often reaching up to as much as 3 mm. Somewhat less compact and less strong are the circular beams which run at rather regular intervals of 3—5 mm. The oblique beams are the least developed; some of the strands composing them are seen here and there to pass the longitudinal beams on the inside, as is long known from other *Euplectella* species. At one end of the specimen the spicular elements of the several beams have commenced to undergo synapticular fusion. Nevertheless, the entire wall readily falls in on slight pressure on the sides.

Specimen F is a small, completely macerated fragment of the skeletal framework, from the lower parts of an individual which in those parts may have measured 25 mm. or over in diameter. Most of the meshes of the framework are quadrate, measuring 2—2.50 mm. in length of sides. The diagonal beams are feeble and scanty. Restricted to the narrowed lower end of the specimen, there occurs synapticular fusion among the elements of the skeletal beams. Notwithstanding the washed-out condition of Specimens E and F, I have but little doubt of their belonging to the same species as Specimens A—D.

Specimen G (pl. VII, fig. 4), the single fragment of *Euplectella* trawled at Station 289, is placed under the present species with a certain degree of reserve. It is again a completely washed-out piece of skeleton from near the lower end of a moderately large individual. The tubular fragment, broken at both ends, is about 55 mm. long; diameter at the upper end 26 mm.; same at the narrowed end 15 mm. or somewhat less. In all the parts, the spicules of the beams are fused together, except the few isolated basalia fibers that still remain apposed to the longitudinal beams. The fusion is especially firm in the lower parts; but even there the wall retains pliability to no small degree. In the middle as well as in the upper parts of the specimen I count precisely 41 longitudinal beams, disposed 1.25—2 mm. apart, in the entire circumference of the wall. At the lower end the same beams number about 39. The transverse beams are set at intervals of about 3 mm. in the upper end and of about 1.50 mm. in the lower. Nearly all the rectangular meshes formed by the two sets of beams above referred to, are elongate in the longitudinal direction. As usual, the oblique beams frequently split and reunite, and instead of confining their course to between the outer longitudinal and the inner transverse beams, may at places send some of the strands over the former or below the latter. The "covered meshes", formed by the crossing and fusion of strands belonging to the right and left systems of oblique beams in the space of certain rectangular skeletal meshes, alternate with the "open meshes" pretty regularly in longitudinal rows; but this arrangement is much disturbed when the meshes are followed in transverse direction, in that there then frequently occur in succession two meshes that are either covered or open. Finally a not unimportant feature of the specimen consists in the fact that the external surface presents a somewhat hispid appearance, which is to be well seen in my figure on the sides (pl. VII, fig. 4). This is due to numerous short spiny processes in rigid connection with the skeletal beams, especially with the oblique beams in the space of "covered" meshes. On closer observation the processes reveal themselves to be composed of fused spicules and spicular rays, such as go to give main support to parietal ledges. Just the same character is always to be seen in the basal parts of the skeleton of *E. aspergillum*, in which the rigid processes in question are seen to develop in the upper parts into the wellknown spiral ridges of that species. Excepting Specimen G, of all the rest of the specimens I have

placed under *E. timorensis*, parts of the skeleton consisting of fused spicules were met with only in Specimen A, E and F; but then, in none of these were the above described processes noticed. This may be due to the said specimens being either in a young state in which the fusion of the beam spicules at the skeleton base has not advanced so far as to extend into those that support the ledges, or to their being fragments that do not include the oldest ankylosed parts of the skeleton basis, — such parts in fact as are represented by Specimen G. However, from the completely washed-out state of Specimen G, the possibility of its belonging to a separate species, other than that represented by the rest of the specimens, cannot be excluded. It is even not altogether impossible that Specimen G belongs to *E. aspergillum*, a species which was recently reported by F. E. Schulze ("Valdivia" Report) to occur on the East African coast, apart from its originally known locality in the Philippine waters. In *E. imperialis*, even in the oldest stage of its life, the basal ankylosed parts of the skeleton (see my Contrib. I., pl. II, fig. 9) seem never to acquire the rigid hispidity described above.

Spiculation. — The spiculation was studied chiefly in Specimens A (fig. 1) and B (fig. 2).

E. timorensis belongs to that group of *Euplectella* in which stauractins — not pentactins — form the groundwork of the circular and longitudinal skeletal beams. In it the parenchymalia principalia are strong, smooth oxystauractins, which, as regards their relative size, their position and behaviour of the rays, conform to what is known from other species of the genus. They are generally largest in the broadest parts of body. A specimen of the spicule from the middle of Specimen A measured 25 mm. in the length of the longitudinal axis and 200 μ in the breadth of rays close to the spicular base. Another from the lower end of Specimen B, over 30 mm. in the length of the longitudinal and 15 mm. in that of the transverse axis, the thickness of rays near base being 140 μ. Still another from the lower end of the large Specimen E (fig. 3) measured 70 mm. longitudinally and 30 mm. transversely. One ray — either the upper or the lower — of the longitudinal axis is frequently much longer than the other, while the two transverse rays are almost always of equal length. The same megascleres in the extreme upper end of the body have the upper longitudinal ray either entirely suppressed or reduced to a mere rudiment while the lower ray of the same axis may be developed to a length of about 10 mm.; their transverse rays form the circular beams of the region, and with a short, radially directed ray, which may be added to them, they help to support the marginal cuff, exactly as is known to me from *E. imperialis* (Ijima 1901, pp. 63, 64).

The diactins and tauactins that accompany the rays of the above stauractin principalia or compose the beams of the oblique systems, or that traverse the flake-tissue in a more or less isolated manner, offer no noteworthy points. Most of them are as usual quite thin and filamentous, but under certain circumstances they may attain considerable dimensions. Thus, in Specimen B I have not seldom met with oxytauactins of several millimetres length and 80 μ thickness and also with oxydiactins fully 15 mm. long and 120 μ thick in the centre. The diactins are only occasionally marked at the most with a central annular swelling.

The flake-tissue of the choanosome contains numerous, medium-sized oxypentactins and oxyhexactins. The latter form was observed rather commonly in Specimen A, but much less so in Specimen B. Rays 165 μ to half a millimetre or over in length; 7—15 μ, sometimes even 30 μ, thick at base; nearly entirely smooth, at most with quite a limited number of

microtubercles near the pointed end. Not all of these spicules are to be classed under the parenchymalia; some of them are without doubt to be called canalaria.

The soldering together of spicules by means of synapticulae is confined to the basal parts of body extending above presumably to about the same extent as in *E. imperialis*. It is principally the spicular elements of the various skeletal beams that undergo the fusion; in addition, some of the supporting parenchymalia of the flake-tissue in direct connection with the fusing parts, may also become involved in the process, especially at an advanced stage of the growth of the sponge. The fact that the skeleton consists of unfused spicules in the upper and by far the greater part of the body serves to distinguish this species at once from *E. aspergillum*.

The basalia, found in complete state in Specimen A only, are characterized in the usual way. Their miter-shaped terminal anchor-knob 120 μ long, as measured from the apex to the level of prong-ends; its width 75 μ in the middle and 100 μ at the prong ends; prongs strong, 6 or 7 in number, may measure 45 μ in length. Axial cross situated at about 330 μ distance from the knob end, between the first and the second prickles of the shaft. Pentactin basalia were not found, but I must say that no special search for them was made.

The dermalia show different degrees of development according to their being situated on the edge of the ledges or on the rest of body surface. Those of the general surface are comparatively small, slender-rayed oxyhexactins, of which all the rays taper gradually to a point and in which the proximal ray is the longest. Distal ray nearly smooth all over or with very sparsely distributed, quite insignificant microtubercles; in Specimen A 200—300 μ long and 6—13 μ thick at base; in Specimen B 170—200 μ long and 8—11 μ thick at base. All the rest of the rays are quite smooth or at the most only sparsely microtubercled near end. Paratangential rays nearly as long as, or longer than the distal; sometimes twice or even more than twice as long. Proximal ray varying in length; when very long, it may be 5—6 times as long as the distal, making the entire spicule exceed 1 mm. in length.

Considerably larger dimensions are attained by the oxyhexactin dermalia occurring on the edge of parietal ledges (pl. VII, fig. 7) and of the marginal cuff, though exhibiting no uniformity in the degree of their development. A large dermalia at the region indicated may have the distal ray nearly 1 mm. long and 30—38 μ or even 45 μ thick near the base, generally tapering to the end and only occasionally showing a very slight fusiform-like swelling in its course. The distal ray is sparsely and obsoletely microtuberculate, appearing nearly quite smooth under a low power of the microscope. The paratangential rays are here much shorter than the distal, while the proximal ray is always several times longer. The distal and the proximal rays, but especially the former, are accompanied by a greater or less number of comital oxydiactins. These are long and slender, generally under 8 μ in thickness, but sometimes as thick as 14 μ, with a length of nearly 1 mm. or over. They are smooth throughout, with neither microtubercles near ends nor an external swelling to mark the center. Similar oxydiactins also occur independently of the dermalia and project freely from the ledge edge to a greater or less extent. These diactin prostalia, together with comitalia-covered distal rays of the specially developed dermalia, form the palisade-like fringe of parietal ledges (pl. VII, fig. 7).

On the marginal cuff of Specimen A were found a number of moderately strong-rayed, regularly shaped oxyhexactins and oxypentactins, which seem to represent the dermalia of the region.

The gastralia are oxypentactins that look quite like those found in the choanosomal flake-tissue. The unpaired distally directed ray is often, but not always, longer than the paratangentials. The latter measure 200—300 μ, or even 385 μ, in length and 7—15 μ thick at base. A few obsolete microtubercles present near the pointed end of rays.

The oscularia, — by which name I designate the characteristic and systematically important spicules of the iris-like membrane of the openings called by me the parietal oscula and by F. E. SCHULZE "die Wandlücken", — are pretty constantly oxypentactins, the rays of which are entirely smooth, taper from base to end and are thus of an elongate conical shape. The rays measure: in Specimen A, 95—140 μ (mostly about 110 μ) in length as measured from the center of the spicules and 10—19 μ (mostly about 15 μ) in thickness at base; in Specimen B, 114—200 μ (mostly about 150 μ) in length and 19—26 μ (mostly about 23 μ) in thickness at base. The difference of the size in the two specimens may be due to age or individual variation, or both. The spicules occur in moderate abundance and proximity to one another. Their unpaired rays are as a general rule directed distally, i. e., outwardly from the cruciate rays as these lie in the iris-like oscular membrane. This seems to stand in unison with F. E. SCHULZE's assumption that the spicules in question may belong to the series of gastralia (Vald. Rep., p. 21). However, it should be mentioned that there occur, in the more peripheral situation, transitional forms that seem to lead over those spicules not only to gastralia but also to certain parenchymalia of the immediate neighbourhood, exactly as I have pointed out in *E. imperialis* and *E. marshalli* (IJIMA, 1901, p. 73 and p. 98).

For the sake of comparison I have reexamined the oscularia of *E. imperialis*, taking up for the purpose an individual of approximately the same size as the Specimen A of *E. timorensis*. I find that the figure (IJIMA, 1901, pl. 11, fig. 17) I formerly gave of the spiculation of oscular membrane in *E. imperialis* is sufficiently representative and no emendation appears to me to be necessary. Now in pl. VII, figs. 5 and 6 I have represented the same parts of both Specimens A and B, where the spicules in question are in about the highest state of development. As a comparison of these figures will show, the oscularia are present in *E. imperialis* far more numerously and more closely packed together than in the Timor specimens. Moreover, in that species a large number of the spicules, especially those situated nearer the free margin of the lid-like membrane, are of much smaller dimensions, the ray-length (measured from the center) very frequently falling under 100 μ — down to 60 μ or even less, — whereas in the Timor specimens oscularia, smaller than 100 μ in the length of rays, are exceedingly rare. On the other hand, the thick conical development of rays in the more peripherally situated oscularia of *E. imperialis*, seems to be never reached by the same spicules of *E. timorensis*, in which the rays are at the most of an elongate or slenderly conical shape. Finally, while in the latter species the oscularia are predominantly, if not exclusively, regular oxypentactins, the same in the former species are quite variable as to the number of rays possessed by each and not infrequently show rays which are rounded at end and thus present a stunted-like appearance.

Of the hexasters the following facts were ascertained.

The floricomes are of the usual shape and mode of occurrence. The same in Specimen A measured tolerably constantly 110 μ in diameter; each slender primary ray with 7, rarely 8, secondary rays in a perianth; claws of terminal plate well developed, easily counted, 5—8 in number.

The same spicules in Specimen B: diameter 106—120 μ; secondary rays 6—8, usually 8, in a perianth; terminal plate with 7 or 8 claws.

The oxyhexasters, quite the same in general characters as those of *E. imperialis* and *E. marshalli*, were numerously met with in Specimen A, but much less in Specimen B. Diameter in the former 70—80 μ; in the latter 60—72 μ. In both cases, primary rays exceedingly short; each with 3—4, sometimes only 2, secondary rays, which are smooth and nearly straight except at base. It may here be observed that the primary rays are never of such a considerable length as has been depicted by Claus [1]) and F. E. Schulze [2]) for *E. aspergillum* and by F. E. Schulze [3]) for *E. regalis*.

Graphiocomes I have failed to discover in Specimen B; but I am strongly inclined to ascribe this negative result, not to their real absence, but rather to certain circumstances in connection with the condition of the specimen. I am strengthened in this belief all the more by the fact that in Specimen A I have cases of isolated rhaphides of the usual appearance occurring near the dermal surface in sections of the wall, and also abundance of same closely grouped in sheaves in the youngest part of the wall close to the marginal cuff. The rhaphides measured 160—200 μ in length. There can be no doubt whatever that they are detached secondary rays of graphiocomes.

Remarks. — Of all the hitherto known *Euplectella*, there are two species which most closely resemble the present one, viz., *E. imperialis* of the Japanese coast (365—1002 m.), and *E. regalis* F. E. Sch. of the Indian Ocean (Andamans, 741 m.). At first I was inclined to refer the Timor specimens to one or the other of these species; however, in view of certain peculiarities of the spiculation noticed below, I have come after all to regard it expedient to give them a distinct specific status, for the present at least.

In shape and in the character of parietal ledge, *E. timorensis* as judged from the single complete specimen in hand (Spec. A). may be said to be scarcely distinguishable from not fully grown individuals of *E. imperialis* (e. g. such as is shown in my Contrib. I, pl. I, fig. 3). Since the specimen just referred to is evidently still immature, it remains yet to be seen whether or not a full-grown *E. timorensis* acquires the same characteristic external appearance as a mature *E. imperialis*. As regards spiculation, there likewise exists a close agreement between the two species, except in the facts before pointed out in connection with the oscularia, viz., that in *E. imperialis* the spicules are much less constant as to the number of developed rays they possess and occur more numerously together, many of them being much smaller in size and more stunted-like in the appearance of their rays. Perhaps it is also worth pointing out here that in *E. imperialis* the floricome (90—105 μ dia. instead of 106—120 μ) is somewhat smaller, but the oxyhexaster (83—92 μ dia. instead of 60—80 μ) attains a somewhat larger size, than in *E. timorensis*. Finally, if I am right in referring Specimen G to *E. timorensis*, together with the other specimens, the extension of synapticular ankylosis from the ankylosed skeletal beams of sponge-base into parietal ridges of the parts, should be looked upon as forming one of the important points of difference between that species and *E. imperialis*.

---

1) Claus, 1868, Üb. *E. aspergillum*. Taf. II, fig. 17.
2) F. E. Schulze, 1887, Chall. Rep., Pl. III, fig. 1.
3) F. E. Schulze, 1902, Ind. Triax., Pl. XXII, fig. 6.

E. regalis F. E. Sch. (1902, p. 61) is known from a single, apparently full-grown specimen; so what differences it exhibits in external appearance from the immature specimen of *E. timorensis* do not seem to carry much weight in differentiating or identifying the two species. On the other hand, the spiculation again presents some tangible points of deviation, on the strength of which they might well be kept separate. In the first place, according to F. E. Schulze (l. c.), the free distal ray of dermalia in *E. regalis* is "covered with short spines [1]) for the greater part of their length, frequently right down to the vicinity of the centre of the spicule", — which description is by no means applicable to the same spicular ray in *E. timorensis* (cf. ante). The oxydiactin comitalia to the said ray in *E. regalis* are said to be rough and supplied with well-defined, knot-like, central swelling; whereas the same in the present species are quite smooth throughout their entire length. Further, in the species of F. E. Schulze the floricome (80—100 μ dia. instead of 106—120 μ) is appreciably smaller, while the oxyhexaster (about 100 μ instead of 60—80 μ) seems to be on the whole larger than in my species. Finally attention should be called to the not inconsiderable difference in the appearance of oxyhexasters in the two species. F. E. Schulze describes the primary ray of that rosette in *E. regalis* as "short and slender" and gives to it in his figure (his pl. XXII, fig. 6) a length approximately equal to that of the primary ray in the floricome. This is by far a much greater length than in any oxyhexasters I have seen in *E. timorensis*, in which species the said rosettes closely agree with the same of *E. imperialis* or *E. marshalli* in the proportional development of their parts. I may add that the secondary rays of oxyhexasters, as they run on after springing from the end of a primary ray, take more diverging courses in my species than are represented by F. E. Schulze for his *E. regalis* in the figure above referred to. The sigmatocomes, described by the same author from his species, may be left out of consideration here, since I believe they are simply immature floricomes. The same may be said of the absence of graphiocomes in *E. regalis*, as I think, I am justified in greatly doubting the constancy of their absence.

Subfamily b. Corbitellinae Ijima, 1903.

Euplectellinae partim, F. E. Sch., 1886, p. 37; 1887, p. 52.
Taegerinae F. E. Sch., 1886, p. 41; 1887, p. 94; 1896; 1899*a*, p. 98.
Corbitellinae Ijima, 1902, p. 30; 1903, p. 27. — F. E. Sch., 1904, p. 173.

Euplectellidae firmly attached to the hard substratum by compact base.

In this subfamily, choanosomal megascleres are most commonly hexactins and rhabdodiactins, the latter being here in much greater evidence than in the Euplectellinae.

Comprising twelve genera. For a key to them, see F. E. Schulze's "Valdivia" Report (1904), p. 173.

In the "Siboga" collection are contained two genera, *Regadrella* O. Schm. and *Bolosoma* (Ij.), each represented by a new species.

1) "Mit kleinen Zacken oder Stacheln besetzt" etc. F. E. Schulze, in Hex. des Ind. Oceans, III (1900*a*), p. 28.

Genus **Regadrella** O. Schmidt, 1880.

Regadrella O. Schmidt, 1880, p. 61. — Ijima, 1901, pp. 220—222. — F. E. Sch., 1904, p. 134?

Tubular or saccular Euplectellid, firmly attached to the solid substratum by a hard, knobby base. Superior end having a sieve-plate, which may be represented by remnants of its beams — a number of spicular rays in a wreath. Lateral wall with round parietal oscula. Skeletal beams running obliquely; with strong diactins as their principalia; fused together in the lower part of the body. Parenchymalia accessoria thin-rayed diactins, hexactins, etc. Hexasters of three kinds: 1) floricome, 2) graphiocome and 3) either onychaster or oxyhexaster, which latter is generally reduced to the form of oxystauraster.

1. *Regadrella cylindrica* n. sp. (Plate VIII, figs. 9—21).

Stat. 122. 1° 58′.5 N., 125° 0′.5 E. 1264—1165 m. Three specimens.

Diagnosis. — *Regadrella* of tubular shape, with probably well-developed parietal ledges. Spiculation essentially same as in *R. okinoseana* Ij.[1]) or *R. decora* F. E. Sch.,[2]) except in the details of spicules and in the fact that parenchymal microxyhexactins are wanting. Without oscularia. Floricome, 106—115 μ in diameter. Oxystauraster, 100—130 μ in diameter. Graphiocome present.

Description. — The "Siboga" expedition trawled at Station 122 (depth 1264—1165 m.), off the northern extremity of Celebes, three specimens (A—C) of *Regadrella* which I will designate, for the present at least by the name of *R. cylindrica*, though in the future they may possibly be found to deserve no more than a varietal or subspecific distinction under either of the two known species (*R. okinoseana* and *R. decora*[3]) of the genus that are characterized by the possession of oxystauraster.

The Specimen A (pl. VIII, fig. 9) I make the type of *R. cylindrica*, as being the best preserved of all, though apparently not an individual that has attained its full growth. It is of a tubular shape, 142 mm. long and approximately circular in cross-section. Breadth of body about 27 mm. at the middle and 18—20 mm. at the upper extremity. In one aspect of the body, this is somewhat ventricose in the lower half. A gently convex sieve-plate terminates the upper, rather truncate looking end, while the lower end, severed from the basidictyonal mass, but closed by a porous bottom-plate, is contracted and does not measure more than 6 mm. across. The sieve-plate shows numerous, variously shaped meshes with rounded corners and separated by beams half a millimeter or less in width; they are of all sizes, up to those which measure 4 mm. in the longest diameter. The lateral wall is for the greater part thin, soft and pliable. Near the lower end of the body, it is at places 3 mm. thick, and is firm or almost rigid owing to the ankylosis of parenchymal beams. As usual the ankylosis gradually disappears above, probably stopping altogether within the lower third of the body. Parietal oscula in the middle and lower parts reach up to 2 mm. in diameter and are separated from one another by

1) Ijima, 1901, p. 223.

2) F. E. Schulze, 1900, pp. 30—34; ditto, 1902, pp. 67—70.

3) In my Contribution I., I regarded F. E. Schulze's *R. decora* of the Indian Ocean to be synonymous with the Japanese *R. okinoseana*. I now see this was too hasty a conclusion and beg here to withdraw my statements in that regard.

wide intervals. Those in the upper parts are much smaller and more closely situated. Each parietal osculum is supplied with a thin, sharp-edged, lid-like membrane. The spaces between the oscula show signs of much abrasion, the natural external surface being nowhere preserved, except at such limited places as are protected from external influences owing to their depressed situation. At some parts close to the lower end of the body, the surface of the almost rigid wall rises into a low ring-like ridge around each parietal osculum, so that the latter opens at the bottom of a shallow depression. Such firm ridges are in our knowledge nothing else than parietal ledges, of the parts, consolidated by fusion of spicules. Their presence sufficiently indicates that soft parietal ledges supported by loose spicules, must have been originally present in all the upper parts of the specimen, though to what extent they were developed cannot be exactly told. This view finds further support in the fact that here and there in the upper parts are found some parenchymal spicules projecting with their ends freely out of the abraded surface and which in all probability originally stood in connection with the ledges that had fallen off. Scarcely a trace is left of a marginal cuff, but this I presume was likewise originally present. As in all *Regadrella* species, the principal supporting strands of the parenchymalia run obliquely in two intersecting sets. They constantly split and unite, bringing about a very irregularly meshed basket-work. In the growing parts, i. e., in the uppermost region of the lateral wall, I see beneath the oblique systems, a number of rather close set strands that run in an approximately transverse direction. The internal surface of the wall needs no description, presenting much the same appearance as in all hitherto known species of the genus.

Specimen B (pl. VIII, fig. 10) is a completely washed-out, snowwhite coherent skeleton, representing the lower $^1/_3$—0.5 of an individual which must have measured considerably over a foot in total length. The skeleton itself is about 210 mm. long. It is tubular in shape, gently broadened from below upward. The lower end, broken off apparently very close to the basal disc, measures only about 17—20 mm. across; the upper end, oval in sectional outline, is 35—50 mm. in diameter. The specimen may be said to comprise nearly all those parts that are composed of ankylosed spicules and that should remain behind after the loss of all the loosely spiculed parts by a thorough-going macerating process. The greater part of the skeletal wall is quite rigid; only in the uppermost parts it is elastic, owing to incomplete fusion of skeletal fibres. In the lower half of the specimen, the round parietal oscula, measuring up to 3 mm. in diametre and situated at varying distance from one another, open each in the middle of an irregularly shaped, depressed area of the surface. In other words, the interoscular external surface is raised more or less, sometimes simply into the form of a broadly flattened ridge, but more often to form a distinct, steep and sharp-edged ledge, running midway between any two oscula. The ledge frequently assumes the shape of a peak-like eminence; at other places it is cut up into a series of irregular protuberances. The condition just described gradually passes above into that in which the positions of parietal oscula are only vaguely indicated by wide vacant spaces and the skeletal wall consists merely of intersecting incompletely fused spicular bundles. All these bundles are obliquely running, but I notice that the more externally situated show a weak degree of inclination and are in fact often nearly longitudinal, while the more internally situated run in a more decidedly oblique direction, — thus foreshadowing the arrangement of the skeletal beams we are familiar with in *Euplectella*.

Specimen C is a tubular fragment, open at both ends, of a likewise thoroughly macerated skeleton. Rigid for the most part, the wall breaks up above into elastic shred-like bundles of spicules. Circular in cross-section; length about 95 mm.; diameter at the lower end 19 mm.; ditto at the upper end 40 mm. The individual to which this skeleton belonged must have been somewhat thicker than that of Specimen B.

Both the Specimens B and C are so much like the skeletons known to me of *R. okinoseana* (as e. g. that shown in my Contribution I, 1901, pl. VII, fig. 3) both in general appearance and structure, that so far as concerns the skeletons, it seems impossible to draw a distinction, except perhaps in the more tubular general shape of the Siboga specimens. These also closely resemble the *Regadrella* skeleton figured by F. E. Schulze in the "Valdivia" Report (p. 22; Taf. V, fig. 1) and referred by him with doubt to *R. phoenix*; however, the "Valdivia" specimen seems to have had the rigid parietal ledges either very weakly developed or nearly entirely undeveloped.

From both the Specimens B and C of the "Siboga" material I have entirely failed to bring to view loose spicules, thus lacking an indispensable condition for their strict identification; therefore, their specific identity with specimen A may be said to rest in a degree on assumption. To this assumption I have been impelled by the fact that all the three specimens were taken in one haul of the trawl at the same locality.

Spiculation. — The following description of spiculation refers to that of Specimen A, unless otherwise stated.

The supporting parenchymalia of the wall are predominantly, if not exclusively long and slender diactins, of which the oxydiactin principalia may attain a length of over 50 mm. and a breadth of 110 μ in the middle. In Specimen B I have found the same spicule to be as thick as 180 μ in the thickest parts. As in *R. okinoseana* the fiber-like principalia of the lateral wall are at most gently curved, — not angularly bent as many of the same spicules in *R. decora* seem to be. Moreover, in the species just mentioned they seem to be much shorter (1.5—2 mm.). The thin comitalia are of the usual appearance. Slender-rayed oxyhexactins and oxypentactins of moderately large size were sometimes met with in the wall, but there is some doubt if they were all or in part really parenchymalia and not those that properly belong to the bounding surfaces. Large triactin or pentactin parenchymalia serving as connecting beams between the sieve-plate and the uppermost end of the lateral wall do not occur, as they do in *R. komeyamai* Ij. and *R. delicata* H. V. Wils. and very probably also in *R. phoenix* O. Schmidt [1]).

In the sieve-plate, the parenchymalia, which in dense bundle make up its beams, are mainly oxydiactins with roughened ends and of various length and thickness. A large one may be nearly 90 μ thick in the middle by a total length of 6 mm. or more, while the thinner ones are of the usual thickness of comitalia. Many, especially the larger spicules, are gently curved in a somewhat bow-like manner; others are quite or nearly straight. In the shorter and stout forms it is not unusual to see an annular swelling, more rarely four cruciately disposed tubercles,

1) Re-examining the type of *R. okinoseana* with respect to the special connective parenchymalia here referred to, I find that that species is also entirely devoid of these. This negative fact might also be utilized for differential purpose, if the *Regadrella* species with oxystauraster (*okinoseana*, *decora* and *cylindrica*) are to be generically separated from the rest which have onychasters instead (*komeyamai*, *phoenix*, *delicata*).

around the spicular center, thus giving a compass-needle like appearance to the spicule. Right among the diactins there not infrequently occur small but rather stout rayed hexactins — or other spicular forms with less than six but more than two rays; these are manifestly to be classed among the parenchymals, not only from the manner in which their rays are associated with the diactins, but also because of the fact that of their axes the one running along with a parenchymal bundle is frequently greatly prolonged in excess of the others. On the other hand, as dermalia are to be considered those small hexactins, seldom pentactins, which penetrate a parenchymal bundle with a single, often somewhat prolonged ray, while all the other rays lie above the surface of the bundle. The dermalia are found scattered at wide and indefinite intervals. Their rays are frequently of quite unequal lengths in the same spicule and may be rounded at the free end. Occasionally there occur among the sieve-plate dermalia, as among those of the body proper, unusually thick-rayed forms in which the roughness extends nearly to base of rays, instead of being confined to their outer end. It is by no means always easy to decide whether a hexactin on sieve-plate beams is a dermal or a parenchymal; in fact, I believe a sharp distinction between the two does not exist in the said parts, as it also appears to be the case on the edges of the cuff and parietal ledges in *R. okinoseana* (Ijima, 1901, pp. 230, 235). I have not seen any hexaster or stauraster in the sieve-plate.

Returning to the spiculation of the lateral parietes, it is a rather remarkable fact that in the present species there occur no intermedial parenchymal microxyhexactins, a category of spicules which is found in abundance in the parenchyme of *R. okinoseana*, and, according to F. E. Schulze, also in that of *R. decora*. Oscularia are another kind of spicules which seems to be entirely absent in *R. cylindrica*. In this respect the species is like all fully grown *R. okinoseana*, but unlike *R. decora* which should possess spiny hexactins and pentactins in the oscular membrane.

The dermalia (figs. 11—18) are hexactins which vary much in appearance and dimensions. Those which are met with most numerously and which, forming a very delicate dermal lattice-work, cover most parts — especially the more depressed and protected parts — of the external surface, are relatively small forms with slender and quite or nearly quite smooth rays (figs 11—14). They are frequently oxyhexactins in which all the rays appear alike and are nearly of equal dimensions (150—200 μ or more in length as measured from center and only about 6 μ in thickness at base); at other times the distal free ray is the shortest (measuring only as long as 75 μ or less), while the proximal ray either remains about equally long as the paratangentials or is prolonged more or less in excess over these. The proximal ray may sometimes be more than twice as long as the paratangentials and five or more times as long as the distal. With regard to the free distal ray, it should be added that that ray sometimes — by no means always — shows differentiation from the rest of the rays in that it keeps nearly the same thickness throughout or very slightly thickens distally and terminates with rounded or obtusely conical tip, instead of tapering out to a point like the others.

Together with the above slender-rayed dermalia there occur in certain parts others of much larger size and stouter development, and further characterized by the presence of distinct microtubercles, distributed nearly or quite all over the spicule. Dermalia of this kind (figs. 15—18), by no means uniform in the development of characters, may measure 450 μ in length and 25 μ

or over in breadth at base of the paratangentials, than which the distal is as a rule shorter and the proximal longer. All the rays are usually tapering toward the obtusely or sharply pointed tip. It sometimes happens that one or the other of the axes is curved and not quite straight; also it sometimes happens that the proximal rays have less microtubercles than any other and may be nearly smooth except at base and end. Not only on account of the size but also of the rough surface, due to the presence of microtubercles, such a large, stout and rough-surfaced dermal hexactin presents an appearance strikingly different from that of the first described, more generally occurring kind. Nevertheless, it appears that the two kinds pass into each other by a gradational series of intermediate forms. Owing to the macerated condition of the specimen, it was not possible to exactly determine the position and distribution of the larger dermalia, beyond the facts that they occurred here and there, or a few together, and intermingled with such as are as weakly developed as any in the entire dermal system and that at places they seemed to lie with the plane of their paratangentials at some distance below the delicate latticework formed by the far weaker dermalia, in which case they might serve for subdermalia. In *R. okinoseana*, which likewise has dermalia of very widely varying strength, I have found that those on parietal ledges, but especially on the free edge of same are mostly of the larger and stouter kind and that these appear to take origin from among the parenchymalia, thus offering a point of transition between dermal and parenchymal systems. Presumably a similar state of things obtains in the present species also.

The gastralia (fig. 19), found in irregularly scattered distribution, are pentactins of moderately large size. Thickness of their rays 10—20 μ; they taper but little toward the tip which is usually rounded and subterminally rough only for a short distance. The paratangentials, generally 170—700 μ or more in length, may be unequally long in the same spicule and are frequently not quite straight but somewhat curved. The unpaired distal ray is about as long as the paratangentials or is longer. A knot in place of the sixth ray that had disappeared, is not present. Not infrequently parenchymal diactins intersect the paratangentials on the inner side, as in *R. okinoseana* according to my own observation.

The hexasters or their modifications are the floricome, the graphiocome and the oxystauraster.

The floricomes measure 106—115 μ and on an average 110 μ in diameter; the width across the most expanded part of the perianth of terminals, about 44 μ. Number of terminals in a perianth, 6 or 7; that of claws to a terminal plate, 3 or 4. A detailed description of the floricome seems unnecessary, as it is of typical form and structure. As regards the manner of its occurrence, what I have said for the same rosette of *R. okinoseana* (Ijima, 1901, p. 236) is strictly applicable to the present case also.

Graphiocomes in intact state were never brought into observation; but their presence is not to be doubted from the fact that at places their terminals, the rhaphides, either isolated or in sheaves, were met with. The rhaphides were over 150 μ long.

True oxyhexasters do not seem to occur in the species. In their stead there are to be found in moderate abundance oxystauraster (figs. 20, 21), a form of parenchymal rosettes hitherto known only from *R. okinoseana* and *R. decora* but not from any other species included in the same genus. The oxystauraster measure 100—130 μ in diameter, a size which on the whole is somewhat larger than that of the same spicule of *R. okinoseana* and apparently also of *R. decora*.

The cruciate principals are 11—13 μ long as measured from the central point of the axial cross, with a thickness of about 4 μ or a little less. They are of nearly the same thickness throughout their length and terminate with rounded tip, around which the smooth and slender terminals take their origin. These number 4—6, rarely only 3, to a terminal, are straight or more usually gently curved in a wavy manner, and form widely divergent tufts. In length they measure 46—60 μ, i. e., approximately four times that of the principal, while in the two other species with the same type of rosettes, the ratio of the lengths may be said to be about three to one. The fact, to which attention has been called by F. E. Schulze in *R. decora*, that of the terminals forming a tuft, those which lie in the plane vertical to that of the four existing principals and passing through the axis of the principal they belong to, stand out more divergently than any other terminal in the same tuft, as if in a way to compensate for the loss of the two spicular rays that had disappeared, can be easily verified in the present species. In some cases I have seen the particular terminals in question even to make right angles with the plane of the cruciate principals at the start.

Genus **Bolosoma** F. E. Sch., 1904.

Placosoma Ijima 1903, p. 2. *Bolosoma* Ijima, 1904, p. 305.

Diagnosis. — Corbitellinae with laterally compressed, massively developed, soft body and moderately long, firm stalk. On top, a comparatively small primary osculum leading into the shallow gastral cavity. One side (the front) of the body is covered with a regularly quadrate-meshed, dermal latticework which is supported on another latticework composed of hypodermal fibrous bundles; the other side (the back) presents a more dense-looking surface in which open a large number of secondary oscula leading into the excurrent canal system. Parenchymalia, principally diactins and occasionally hexactins. In certain positions on the front the dermalia may have the proximal ray so reduced in length as to be not longer than the short distal ray. Gastralia, hexactins. Hexasters in three varieties: the hexactinose discohexaster, smallest and most numerous; the spherical discohexaster, large and extremely beautiful, confined to the back side of the sponge; and the hexactinose codonhexaster found under the gastral layer. Floricome and graphiocome not present.

1. *Bolosoma cavum* n. sp. (Plate VIII, figs. 1—8).

Stat. 177. 2°24′.5 S., 129°38′.5 E. 1633 m. One incomplete specimen (B).
Stat. 300. 10°48′.6 S., 123°23′.1 E. 918 m. One incomplete specimen (A).

Diagnosis. — Corbitellinae with vase-like body; the spacious gastral cavity extending below into the firm stalk-like base. Upper parts of body unknown. Wall moderately thin, supported by strong, compact, fibrous bundles which divide and subdivide as they proceed upwards from the sponge base; perforated by numerous, roundish, parietal oscula, distributed probably throughout the entire wall on all sides. Parenchymalia, principally diactins, occasionally pentactins and hexactins. Dermalia, hexactins with the comparatively short, nearly smooth distal ray swollen or not swollen towards the rounded end; proximal ray the longest. Gastralia?. Hexasters in three kinds: the hexactinoid microdiscohexaster (23—38 μ or over in diameter); the spherical holodisco-

hexaster (113—133 μ diameter); and the hexactinoid codonhexaster (152—180 μ diameter), which are the most numerous. Floricome and graphiocome not found.

Description. — This new species is based on two small specimens, A and B, obtained respectively off to south of the west end of Timor (Stat. 300) and in the Ceram Sea (Stat. 177). Both are incomplete, representing only the lower parts of the sponge body, the upper parts having been torn off and lost.

Specimen A (pl. VIII, fig. 1) I make the type of the species, as being in a better state of preservation. It is of a vase-like shape standing on a compact basal disc, by means of which the sponge must have been attached to the firm substratum. It is about 45 mm. high and about 17 mm. broad at the upper broken end. Inferiorly the body gradually narrows to a breadth of only 3—4 mm. at the junction with the basal disc. This is irregular in outline, measuring 9—11 mm. across; its upper surface is convex and moderately smooth, while the lower attachment surface is quite uneven. The wide and deep gastral cavity is widely open above at the torn end and extends below nearly to the basal disc, thus giving to the body a hollow vase-like form, in which respect the present species stands in marked contrast to the only other known species of the genus, the stalked but eminently thick-bodied *Bolosoma paradictyum* Ij. (Ijima 1903, pp. 2—19). In what manner the specimen terminated above in its original uninjured state, cannot be told. The cross-section of the sponge body that remains is irregularly polygonad.

As regards the macroscopic structure of the sponge, there arise pretty close together from the basal disc, three or four, strong, fibrous pillars or compact spicular bundles of 1—2 mm. thickness for the support of the body. These main pillars, as they proceed upwards, diverge from one another and run along the angular edges of the sponge on the external side, at the same time splitting into secondary bundles or sending out branches as enter into the support of that part of the wall which extends between the main pillars. The appearance of these pillars and their branches reminded me somewhat of F. E. Schulze's figure of *Dactyocalyx gracilis* in the "Challenger" Report. The wall between the main pillars is at certain spots about 2 mm. thick but is in most places much thinner, at places even nearly as thin as paper. It is perforated by a number of prominent roundish, oval or elongate apertures which are apparently homologous with the parietal oscula of *Euplectellina*. They are of various sizes, measuring up to 3 mm. in diameter and in one case 3 mm. by 5 mm. in dimensions. They lie quite irregularly distributed, here pretty close together and there more isolated. The entire external surface of the sponge shows signs of much laceration; the principal supporting bundles are exposed and nowhere is the dermal lattice preserved intact, so that the usual feltwork of parenchymal fibres directly meets the eye. On the gastral surface the supporting bundles are all covered up; numerous excurrent canals are distinguishable on this side in the form of large and small openings or niche-like depressions, of which the larger may measure about 1 mm. across.

Specimen B (pl. VIII, fig. 2), from Ceram Sea (Stat. 177), is a narrow elongate fragment about 80 mm. long, evidently the stalk-like lower parts of an individual, of which the main upper parts had been torn off and lost. The lowest end of the specimen represents a single fibrous rod of firm consistency. Superiorly this splits first into two, and further above into more, compact fibrous bundles, which finally, at the upper end, pass over into a small, irregular swab-like flap of felted fibers, the remnant of the soft sponge wall. A perforation or two in the flap

probably represents the parietal oscula. Except at the lowest end, the stalk incloses an axial hollow, apparently the continuation of the gastral cavity. I have found the specimen very poorly preserved as regards the systematically more important spicules; nevertheless, a study of what spicules that remained has led me to the conviction that I have here to do with a sponge specifically identical with the Specimen A. I have come to this conclusion especially from the discovery of a number of hexactinoid microdiscohexasters (30—33 μ diameter) and of certain hexaster fragments, likely of both the spherical holodiscohexaster and the large hexactinoid codonhexaster.

Spiculation. — The following description of spicules is based solely on observations of Specimen A.

The parenchymalia are predominantly diactins and only occasionally hexactins or pentactins. The fibrous pillars, which give main support to the sponge, may be said to be composed almost exclusively of slender diactins. These are of variable strength measuring up to 50 μ in thickness and not over 7 or 8 mm. in length; the spicular center is smooth, not marked by any kind of swelling, the ends are rough-surfaced and rounded or obtusely pointed, sometimes slightly swollen. Mingled among these diactins, I have seen, though rarely, medium-sized hexactins in which the axis, running along with the diactins, is more or less prolonged over the others. Synapticular fusion of the spicules occurs extensively in the basal disc as well as in the main supporting pillars. The latter show it still in the middle parts of the specimen, but it no longer exists in the upper torn end.

The felted parenchymalia of the soft wall are mainly diactins similar to the above and generally measuring 7—15 μ in thickness in the middle. Nearly regular hexactins and pentactins not differing much in size from the dermalia are not infrequently met with, either more or less isolated or penetrating with one of the rays into a bundle composed of diactins. I am however unable to say if all these hexactins and pentactins are to be classed with the parenchymalia. I should rather think that at least some of them are to be looked upon as canalaria or gastralia, especially since I have failed, on both sections and pressed preparations, to come across a hexactin or a pentactin, which, from its position or mode of arrangement, could indubitably be recognized as canalaria or gastralia, probably owing to the dilapidated condition of the specimen.

As dermalia I consider the hexactins (pl. VIII, fig. 3) commonly met with in the preparations and in which one ray — evidently the distal free ray — is differentiated from the rest in being much shorter and of a different appearance. That short ray is generally 55—88 μ long and 7.5—11 μ thick near base; the thickness may remain nearly the same to the end or increase considerably so as to give the ray a somewhat club-like appearance; the tip itself is always rounded. Moreover the ray is either nearly entirely smooth or is sprinkled on the surface with a greater or less number of very obsolete microtubercles, which might easily escape notice unless a high power of the microscope be used for observation. The cruciately disposed rays, i. e., the paratangentials, are usually 170—266 μ long; sometimes I have seen them to be over 350 μ and once even 450 μ long; in some cases the paratangentials of one and the same spicule were of unequal lengths, instead of being equally long which is usually the case. The sixth ray, standing opposite to the shortest and apparently the proximal, may be of about the same length as the paratangentials, but is more generally considerably prolonged so as to be

twice or thrice longer. All the rays, except the shortest, taper gradually towards the obsoletely rough, and obtusely pointed, end.

Most characteristic of the species are the hexasters which occur in three distinct varieties, viz., the hexactinoid microdiscohexaster, the spherical holodiscohexaster and the hexactinoid codonhexaster. All the three seem to occur together in choanosomal septa.

The hexactinoid microdiscohexasters (pl. VIII, figs. 6, 7) occur in a sparse number, though at places several of them were seen not far distant from one another. They measure in axial length 23—38 μ, in one case 50 μ. The moderately strong rays are of about the same thickness for the greater part of their length, expanding slightly at the junction with the strongly convex watch-glass-like terminal disc. This measures up to 7.5 μ in diameter; its prong-like marginal teeth 12 or 13 in number. Occasionally the microdiscohexaster is hemihexactinoid (pl. VIII, fig. 5), and then it is usually somewhat larger than the strictly hexactinoid form of average size. Thus, in one case, one of the six rays was divided at a short distance from the center into two divergent terminal rays; this measured 38 μ in diameter. In another case, three or four of the rays were divided in a like manner, giving ten terminal discs in all; the diameter in this case measured 53 μ. Here is seen an approach of the hexactinoid microdiscohexaster to the spherical discohexaster next to be described. Nevertheless, an uninterrupted gradational series of transitional forms leading the one form over to the other does not exist.

The spherical holodiscohexasters (pl. VIII, fig. 4) are present in about same numerical proportion as the above. In appearance they resemble those of *Bolosoma paradictyum*, though smaller in size. Diameter 113—133 μ. From each exceedingly short principal, there arise 3 or 4, sometimes 5, slender terminals, which at the outer end are swollen and are capped each with a strongly convex disc bearing 13—16 prong-like marginal teeth. The terminal disc is about 15 μ in diameter. The terminal rays diverge in such a way that all the terminal discs are nearly uniformly distributed in the periphery of the rosette.

The hexactinoid codonhexaster (pl. VIII, fig. 8) were met with in much greater abundance than the other varieties. They look quite like the same from *Bolosoma paradictyum*. Diameter 152—180 μ. The sexradiate rays are slightly swollen at base as well as at the outer end; for the rest they are exceedingly slender, in which parts they may be bent in an accidental manner and are not less infrequently broken off. The bell-like terminal umbel is somewhat truncate at the top; it is 26—30 μ long and 23—25 μ broad at the bell entrance; the long teeth of the sides number 15 or 16.

Notwithstanding prolonged special searches I have not met with a single floricome or graphiocome.

Remarks. — The hexasters of the present species, so far as their kinds go, agree perfectly with those of *Bolosoma paradictyum*. It is solely on this account that I take no hesitancy in deciding upon the generic identity of the two species. At the same time the differences in details with respect to the hexasters alone, seem to be sufficient to establish the specific distinctness of the present form, even if we were to entirely set aside its remarkable difference in general form and structure from the only other known species of the genus. In the latter respect the deviation may be said to equal nearly that which obtains between the two known species of the genus *Walteria*, viz., *W. flemmingi* F. E. Sch. and *W. leuckarti* Ij.

The discovery of the second species of *Bolosoma* does not bring us any nearer to the solution of the exact position of the genus in the Corbitelline series of the Euplectellidae, aside from the hints I have given on p. 28 of my Contribution III, 1903.

Indeterminable Euplectellids.

The following are those specimens which, though without doubt referable to the family *Euplectellidae*, cannot possibly be exactly identified on account of their fragmentary and thoroughly washed-out condition.

1. From Station 59 (western entrance to Samau Strait, Timor; 10° 22′.7 S., 123° 16′.5 E.; 390 m.) we have a small fragment consisting of firmly ankylosed spicules and broken off evidently from the rigid basal parts of the skeletal tube of a *Regadrella* or a *Regadrella*-like Euplectellid. It comprises a single round and sharp-edged parietal osculum of 3 mm. diameter, surrounded by a ridge-like elevation of the external surface, so that it opens at the bottom of a dimple-like concavity. Thickness of the wall about 5 mm., as measured from the gastral surface to the highest part of the external ridge. Free spicules entirely lost. The character of the gastral surface as well as of the dense parenchymal mass exactly like that of the basal parts of *Regadrella* skeleton. In fact I am inclined to refer the specimen to that genus. Possibly it represents *R. cylindrica* Ij. obtained by the "Siboga" to the north of Celebes; also not impossible that it is specifically identical with the macerated specimen which was obtained by the "Valdivia" near the Nicobars in 805 m. depth and denominated by F. E. Schulze "*Regadrella*? *phoenix* O. Schm." (Vald. Rep. p. 22; Taf. V., fig. 1).

2. Station 251 (S. of Kur I., 5° 28′.4 S., 132° 0′.2 E.; 204 m.) has yielded a fragmentary piece, about 60 mm. broad and long, of a latticed skeletal tube (pl. VIII, fig. 22), probably belonging to a Corbitelline form standing close to *Corbitella*, *Heterotella* or *Regadrella*, if not actually identical with one or other of these genera. Anyway I am quite at loss for the present to identify it with any of the species which have a skeleton of a similar structure. The piece is rigid in all its parts and consists of intersecting, slender, closely appressed and fused beams of various strengths under half a millimeter thickness. The synapticularly bound spicular elements of the beams seem to be exclusively long and slender diactins. A series of long beams run longitudinally or approximately so, leaving interspaces of 2—6 mm. between them. Intermixed with these and without forming a distinctly separable system, there are numerous obliquely running beams; and finally, on the inner i. e., the concave, side of the piece there are transverse beams, running 10—15 mm. apart and each presenting a loose bundle-like appearance. The structure brought about by the above beams is a comparatively thin, irregularly meshed latticework of a light and somewhat delicate appearance. The larger meshes, which may measure 3 mm. across and which occur apparently without definite rule as to the manner of distribution, no doubt indicate the positions of parietal oscula. Judging from the curvature of the entire fragment, this was probably derived from a somewhat ventricose part of a tubular individual which should have measured about 60 mm. in diameter at that part.

There exist in the "Siboga" material three more small fragments of essentially the same characters as the above and doubtless specifically identical with it, but unfortunately without a

statement of locality. In them the site of parietal oscula is more distinctly indicated by roundish open meshes, generally about 2 mm. in diameter and 2—7 mm. distant from one another.

3. From Station 95 (Southern part of Sulu Sea, near Pearl Bank; 5°43′.5 N., 119°40′ E.; 522 m.) is a vial containing three very small lattice-like fragments and a likewise fragmentary basal end of a tubular Euplectellid. The former is not without resemblance to the above described fragment from Kei Islands; the latter is something that might well pass for the solid attachment base of any Corbitelline form of a structure similar to that of e. g. *Regadrella*. It is impossible to say anything definite about the identity of the species.

4. From Station 226 (Middle of Banda Sea; 5°26′.7 S., 127°36′.5 E.; 1595 m.) there are a number of small, rigid, strong-beamed, lattice-like fragments, the largest being not more than 18 mm. square and 2—4 mm. thick in the thicker parts. The component spicules are apparently all diactins, synapticularly fused into compact beams. Of the latter, those that run longitudinally or nearly longitudinally are the strongest, mostly measuring 1 mm. and over in thickness. These are connected by internally situated oblique beams, and inside of all these there seem to exist transverse beams at comparatively wide intervals. Of the variously sized and irregularly shaped open meshes exhibited by the fragments, the larger, up to 5 mm. in length, are evidently those which contained parietal oscula. Here again, nothing more can be said than that we have probably to do with fragments from the lower parts of the tubular skeleton of a *Regadrella*-like Corbitelline Euplectellid.

5. From Station? (Label not discovered in the bottle containing the specimens). Rigid bases, representing eight medium sized individuals of a Corbitelline Hexactinellid, possibly of *Regadrella* sp. All the fragmentary specimens must have been long dead before they were obtained. They are much corroded, discoloured and without a trace of free spicules. Four of the bases are grown together into a single solid piece.

Family Caulophacidae Ijima, 1903.

Asconematidae partim, F. E. S., 1886, p. 44; 1887, p. 113; 1897, p. 521; 1899*a*, p. 98.
Caulophacidae, Ijima, 1903, pp. 78, 112. — F. E. S., 1904, p. 173. — v. Ldfld., 1915, p. 47.

Lyssacinosa of goblet-like or mushroom-like body, always stalked and firmly attached at base; solitary or forming small branching stock. Ectosomal skeleton of small hexactine, seldom pentactine, pinular dermalia and of strong pentactine hypodermalia; the latter generally alone, seldom supplemented by rhabdodiactine hypodermalia. Choanosomal megascleres of hexactins and rhabdodiactins. Hexaster various, with or without strobiloplumicome.

This family is now conceived to consist of four genera as follows: *Caulophacus* F. E. Sch., 1886 (> *Pleorhabdus* F. E. Sch., 1887; > *Balanella* F. E. Sch., 1887), *Caulodiscus* Ij. (new genus instituted for *Caulophacus lotifolium* Ij. 1903), *Caulophacella* v. Ldfld., 1915, and *Lympagella* O. Schm. (> *Aulascus* F. E. Sch., 1886; > *Calycosoma* [*gracile* F. E. Sch., 1903; not *C. validum* F. E. Sch., 1899]; > *Calycosilva* v. Ldfld., 1915).

Key to the genera.

A. Without strobiloplumicome.
  a^1. Strong-rayed discohexaster with barbed rays, varying from holohexasterous to hemihexasterous or hexactinoid.
    a^2. The second hexaster form present is the discohexaster with slender terminals (generally lophodiscohexaster or discome with prolonged principals) . . . . . **Caulophacus** F. E. Sch.
    b^2. The second hexaster form present is the onychaster with slender terminals . . . . . **Caulodiscus** Ij.
  b^1. The only hexaster present is the oxyhexaster, both holohexasterous and hemihexasterous; with short principals and minutely barbed terminals . . . . . **Caulophacella** v. Ldfld.
B. With strobiloplumicome. (Other hexaster constantly present is the onychaster in one or more varieties) . . . . . **Lympagella** O. Schm.

Genus **Caulophacus** F. E. Sch., 1886.

Balanites F. E. Sch., 1886; 1887, pp. 122, 372.
Balanella F. E. Sch., 1887.
Caulophacus F. E. Sch., 1886; 1887, pp. 124, 373; 1897, p. 525. — Ijima, 1903, p. 85.

1. *Caulophacus* sp.? (Plate IX, fig. 18).

Stat. 226. 5° 26′.7 S., 127° 36′.5 E. 1595 m. One fragment.

At Station 226, between Schildpad and Lucipara Islands, in the middle of Banda Sea, was obtained a completely macerated, thrice dichotomously branched and entirely rigid stalk of a Hexactinellid, bearing signs of its having lain a considerable length of time on the sea-bottom after death of the sponge.

It is broken off at the lower end as are also the ends of all the branches. The entire specimen measures 86 mm. in height. The branches are 3—5 mm. thick, except the swollen terminal parts of one of the two uppermost branches. The swelling referred to is of an oblong shape, measuring about 19 mm. in length and 8 mm. in thickness in the middle. Presumably other branches had shown each a similar swelling before the parts were lost by breaking off. The entire stalk is traversed by a narrow axial lumen, about 1.5 mm. wide in the above mentioned swelling and scarcely 0.5 mm. at the lowest broken end of the specimen. The external surface throughout shows some longitudinally running fibers, while the substance between these appears to the naked eye to be nearly homogenously compact. Under the lens, however, the same presents a fine tessellated like sculpturing, not unlike the texture of a closely woven fabric, consisting of pores or minute meshes arranged in longitudinal series. The appearance is due to the synapticulae that transversely connect the fibers of the stalk. At places and especially when wet, the surface may appear finely granulated, the granules being disposed in longitudinal lines.

A microscopic study of the specimen showed that the spicules composing it are long diactins 55 μ and under in thickness. As already indicated, these are firmly soldered to one

another by numerous synapticular trabeculae, the meshes thus formed varying from 3 or 4 μ to nearly 175 μ in size. The meshes in the superficial strata are much smaller in the more internal parts of the stalk. Free spicules of any kind were entirely missing.

Of all the stalked Hexactinellids known to me from descriptions or from direct observation, including the Caulophacid genus *Caulophacus*, I know of no species that has the stalk structurally similarly characterized as the one here described. Possibly the specimen represents a new form, but it admits of no exact systematic determination. It is only as a provisional matter that I have placed it under the Caulophacidae.

Family Rossellidae (F. E. Schulze, 1886), Ijima, 1903.

Rossellidae, F. E. Sch., 1886, p. 47; 1887, p. 129; 1897, p. 532; 1899*a*, p. 101.
Asconematidae partim, F. E. Sch., 1886, p. 44; 1887, p. 113; 1897, p. 521; 1899*a*, p. 98.
Rossellidae, Ijima, 1898, p. 41; 1903, p. 114; 1904, p. 1. — F. E. Sch., 1904, p. 175.

Lyssacinosa of cup-like or sacciform body; sometimes stalked; generally firmly attached at base and exceptionally rooted by basal processes or by tufts of pentactine basalia. Besides the main terminal osculum, a few secondarily formed oscula may occur. Ectosomal skeleton composed of small, rough dermalia with a variable number of rays (generally pentactine, stauractine or rhabdodiactine) and of hypodermalia which are either pentactins or rhabdodiactins, or both. The dermalia, when provided with distal ray as they occasionally are, have that ray much like the rest in appearance and not distinctly pinularly developed. Pentactine hypodermalia often show a tendency to protrude outwards in such a way that the paratangentials form a veil-like covering over dermal surface. Choanosomal megascleres of hexactins and rhabdodiactins, or of the latter only. Hexaster various but generally oxyhexaster and discohexaster, but sometimes either of the two in exclusion of the other. Oxyhexaster often hemihexasterous or quite hexactinoid. Discohexaster may be modified into discoctaster.

Differential key to subfamilies.

A. Without discoctaster.
  a^1. With strobiloplumicome . . . . . a. Lanuginellinae.
  b^1. Without strobiloplumicome . . . . . b. Rossellinae.
B. With discoctaster . . . . . c. Acanthascinae.

Subfamily a. Lanuginellinae F. E. Sch., 1897.

Lanuginellinae F. E. Sch., 1897, p. 532. — Ijima, 1898, p. 44; 1904, p. 2.

Hypodermalia exclusively pentactins. Choanosomal megascleres of hexactins and rhabdodiactins; rarely of the latter only. Strobiloplumicome always present among the hexaster, which for the rest consists of either discohexaster or oxyhexaster, or of both.

For a key to the general and species, see Ijima, 1904, p. 3. Since that was drawn up, v. Lendenfeld (1915, p. 103) has added a fifth genus *Lanugonychia* (*flabellum* v. Ldfld.), a

form probably firmly attached by the stalk-like base and characterized by having dermalia with a varying number of rays, and both discohexasters and onychasters in abundance besides strobiloplumicomes.

Genus **Lophocalyx** F. E. Sch., 1886.

Lophocalyx F. E. Sch., 1886, p. 374, pp. 132—133.

Diagnosis. — Lanuginellinae with cup-shaped and thick-walled body which is provided with a wide circular oscular aperture and rooted in the mud by means of a basal tuft. External surface presents spherical papillae, each bearing a tuft of long pleuralia on the apex and frequently giving rise to buds. Parenchyma contains numerous oxyhexasters with long principal rays, each with three long divergent terminals. Plumicomes present. In the skin, above the medium-sized hypodermal oxypentacts, there occur small, slightly incurved, cruciate autodermal tetracts. The pleuralia and basalia pass inferiorly into anchors with four slightly curved transverse teeth.

1. *Lophocalyx suluanus* n. sp. (Pl. IX, figs. 1—5).

Stat. 97. 5° 48′.7 N., 119° 49′.6 E. 564 m. 2 specimens.
Stat. 251. 5° 28′.4 S., 132° 0′.2 E. 204 m. 2 specimens.
Stat. 253. 5° 48′.2 S., 132° 13′ E. 304 m. 3 specimens.

Diagnosis. — Ovoid with simple-edged osculum above; dermal surface without conuli; pleural prostal needles and basal anchoring fibers standing out mostly singly without forming distinct tufts, giving to the sponge an echinated appearance. Spiculation as in *L. philippinensis*, but with somewhat more strongly concave and weakly microtubercled stauractine autodermalia; with quite or nearly smooth-rayed oxyhexasters in which the terminals are as long or even nearly twice (instead of half) as long as the principal, and with plumicomes under 35 μ (instead of being 60—70 μ) in diameter.

Description. — In the southern part of Sulu Sea (Station 97), near Pearl Bank, were obtained two small, probably not yet fully grown specimens of *Lophocalyx* which I have named *L. suluanus* n. sp. They will be referred to as Specimens A and B in the following description.

Specimen A (pl. IX, fig. 1) is ovoid, flattened in a direction vertical to the long axis. One of the flattened sides is the sponge base; the other side bears the circular oscular opening. Greatest transverse axis of body, 18 mm. Height of same, 11 mm. Diameter of osculum, 3.5 mm. The dermal surface is in part moderately smooth and in part somewhat uneven; it is devoid of the conical elevations found in *L. philippinensis*. Except on the basal surface, the sponge surface is beset with numerous, radially outstanding spicules of three kinds; 1) coarse needle-like spines (mostly probably diactins) which project out to a variable extent up to about 7 mm. and of which the outer end is invariably broken off; 2) small anchoring spicules, the basalia, with recurved anchor-teeth and standing out of the sponge surface to an extent of 1 mm. or more; and 3) larger orthopentactins with straight-rayed paratangential cross set on a shaft of about 1 mm. length. The first mentioned kind is the most numerous, giving to the sponge an echinated appearance. All the kinds occur promiscuously together. As a general matter, they spring out singly; only occasionally, the needle-like spines are seen to arise close together in

a number of two or three. The diffuse distribution of the projecting spicules is evidently in relation with the absence of the conuli, which in *L. philippinensis* are known to occur even in very young specimens, each bearing prostal spicules concentrated to a tuft. The oscular margin is sharp-edged and without fringing prostalia. Internal to the osculum is a moderately deep gastral cavity, on the wall of which freely open a number of variously sized excurrent canals, 3 mm. and under in diameter. The sponge wall is about 7 mm. thick in the thickest part.

The second specimen B represents a small irregular-shaped and uneven-surfaced, flattened clump, 15 mm. by 10 mm. broad and 8 mm. high. At the top of the flatly and irregularly conical upper surface is a small osculum measuring not much over 1 mm. across; this leads into a pit-like gastral cavity, remarkably small for the size of the body. Not a trace of prostal spicules is to be seen, the specimen being evidently in an early stage of growth in which the protrusion of those spicules has not yet begun. The lower surface of the body exhibits a depressed area with indication that the sponge rested on a foreign body, touching this directly by the dermal surface of that area. The spiculation of this specimen, except in the absence of prostalia, agrees perfectly with that of Specimen A.

There are in the Siboga collection two more small specimens, C and D, which I will refer to the present species. Both these were trawled at Stat. 251 in Banda Sea, near and to the west of Kei Islands, from a bottom of hard coral sand and 204 m. depth. One of them (Specimen C) is of about the size of the end of one's little finger; the other (Specimen D) is somewhat smaller. Both are of an oblong-ovoid shape, more or less broken in the basal parts and with a simple and sharp-edged osculum of 4 or 5 mm. diameter at the other rounded end. They are decidedly taller than broad. The osculum leads into a comparatively wide gastral cavity, which is however not deeper than half the length of the body. Shallow and niche-like, or deep and pit-like excurrent canals freely join with the gastral cavity. The dermal surface is moderately smooth, not papillated. The prostal spicules had apparently been lost to a great extent; however in isolated positions there still remain of them, some stiff-looking needles (diactin) and the more thread-like anchoring prostals, the former on the sides and the latter more especially numerous in the basal parts. There are thus evidences that both the specimens in the original uninjured state, must have shown prostal spicules in much the same way as the Specimen A from Sulu Sea. A large number of Foraminifera shells were found lodged in the tissues of the two specimens from Banda Sea.

Further from Stat. 253 (near Taam I., one of the Key Islands), we have 3 very small specimens which I have picked out from among the entangled rooting spicules of *Pheronema weberi* Ij. They have all an ovoid or oblong-ovoid shape with small osculum at the top and already show some numbers of prostals, both diactine and anchorate. The largest and the most complete of the specimens is 10 mm. high and 6 mm. broad. The spicules agree well with those of the specimens from Stations 97 and 251.

A plumicome found near the dermal surface measured only 27 μ in diameter.

Spiculation. — The following accounts of the spicules are based principally on the study of Specimen A which I make the type of the species; and it may be taken for granted that, unless specially mentioned, no important deviations from them were noticed in any of the other specimens. The principal parenchymalia are large strong-rayed oxyhexactins and slender

diactins. The former ranges from about 0.5 mm. to 2 mm. or over in axial length. The rays, in a large spicule of the kind, may be 80 μ or more thick close to base, whence they taper somewhat strongly towards the pointed end which is smooth like the entire ray or may possess subterminally a few obsolete microtubercles. These strong parenchymal oxyhexactins are situated generally with one of the axes directed radially in the choanosome.

The parenchymal diactins range in dimension from that of ordinary comitalia (4—7 μ thick) to such as are about 5 mm. long and 45 μ thick in the middle parts. They taper gradually towards both ends, which are mostly pointed, and are either smooth throughout or show slight subterminal roughness. The spicular center is never externally marked with a swelling or with knobs. A part of the thinner diactins occurs as comitalia to the prostal spicules and to the radially directed rays of hypodermal pentactins and parenchymal megascleric oxyhexactins. For the rest the diactins run either singly or in groups or bundles that are sometimes pretty compact and at other times loose and ill-defined. Such diactins are found partly in radial disposition and partly running more or less sinuously or tortuously in indefinite directions. The latter sort is sparse in the midst of other parenchymalia, but occurs abundantly along the wall of the gastral cavity and of the larger excurrent canals, in which positions the intersecting diactins alone form the supporting framework for autogastralia and canalaria.

With regard to the coarse prostal needles, which are found always broken off at the distal ends, I am inclined to think that they are mostly diactins and have originated by protrusion and special growth from the rank of those parenchymal diactins that are disposed radially in the choanosome. I cannot however entirely deny that among the prostals in question may be included the shafts of basal anchors (pentactins) which had lost the distal parts by breakage. The prostal needles may measure 12 mm. or more in total length and 120 μ in greatest thickness. They taper towards both ends, as does also the shaft of basal anchors. In a single case I believe to have distinctly seen in these prostals the axial cross in the course of the axial canal; in several other cases I have missed the cross entirely, although examinations were especially made for the purpose of finding it. This negative result does not weigh much against the assumption that the prostal needles in question are diactins and not the shafts of pentactine prostalia, since a number of indubitable parenchymal diactins examined likewise showed no trace of an axial cross.

The dermal layer is supported by numerous hypodermal oxypentactins of rather small but variable size. Rays straight, entirely smooth or subterminally with a few obsolete microtubercles, tapering from base to end; thickness at or near base up to 35 μ or thereabout. Length of paratangentials up to 550 μ (to over 700 μ in Specimen C). Distal shaft ray longer, reaching a length of over 1 mm. The four paratangentials form a regular cross, the plane of which is perfectly flat or is flatly conical to a perceptible degree on the outer side. Those of different hypodermals are seen under the hand-lens to form an irregularly meshed hypodermal framework, in the composition of which no diactins seem to participate. In some parts of the sponge-surface certain hypodermal oxypentactins stand protruding through and a short distance over the autodermal layer in the well known manner; but prostalia of this kind are by no means numerous and may be said to be of only occasional occurrence. In Specimens B, C and D I have not found any protruding hypodermal pentactins.

Here and there in the same situation as the above hypodermalia are found in similar disposition the pentactinic basal anchors, still imbedded quite in the sponge-body but which are destined eventually to push out their outer anchor end through the dermal layer. A number of them are found already thus protruded amongst other prostalia and in isolated positions on the supero-lateral side of the sponge. The four cruciate but uniformly recurved rays are each traversed by an axial canal throughout their length; they are about 200 μ long as measured in direct line from the spicular center to the sharply pointed end. Their thickness at base, about 22 μ. Direct distance from tip to tip of two opposite rays, 300—360 μ. The shaft ray, so long as the entire spicule still lies in the body, does not much exceed 2 mm. in length, but elongates itself concomitantly with the protrusion, though the anchoring head no longer undergoes further growth. At first the ray is thickest (about 30 μ) at the outer end, tapering very gradually proximad to the finely pointed end; later, the thickest part is found in the middle part of the ray. The longest anchoring spicule I have found in the specimen and unmistakeably recognizable as such by the intact state of the distal end, is about 7 mm. long, 33 μ thick near the outer end and 65 μ thick in the middle part. It was protruded to an extent of about 1 mm. or more over the sponge surface. In Specimen C, I have found the anchors more strongly and stoutly developed than in A. The roughness does not attain a degree which might be called "fast höckerig", as F. E. Schulze ('97 Revision d. Systems der Asconematiden u. der Rosselliden, p. 546) describes the same spicule in *L. philippinensis*.

The autodermalia (pl. IX, fig. 4) are small, faintly rough and rather slender-rayed stauractins which are distinctly convex on the outer side, the convexity being approximately like that of an ordinary watch-glass. The rays taper but slightly towards the rounded or obtusely conical end. They measure 76—91 μ in length and about 7.5 μ in thickness near base. (In Specimen C I have found the rays of stauractin which are longer than in A, measuring 100—130 μ length). Very seldom a knot-like rudiment of a fifth ray occurs on the concave side. The stauractins form an exceedingly delicate autodermal lacework, the meshes of which, more or less quadrate in shape, can be distinctly perceived only under the magnifying glass.

The autogastralia are smooth or nearly smooth, slender-rayed oxyhexactins of a somewhat variable size. Length of ray, generally 80—120 μ; thickness near base, 6—10 μ. Often, but not always, the free proximal ray is greatly prolonged over all the others in the same spicules; it may reach a length of 330 μ, but is not specially characterized in any other respect. The gastralia are not present in sufficient abundance to form a continuous lacework.

Indistinguishable from the regular shaped auto-gastralia are the parenchymal microxyhexactins which occur in moderate abundance in the choanosome. The fact seems to be that the two kinds of spicules pass over into each other. The same relation probably exists between the parenchymal microxyhexactins and the canalaria, if it be at all necessary to make this distinction. As a matter of fact, I have seen no spicules that in any way characterized themselves as the latter in distinction from the former, except in the position of their occurrence.

The hexasters of the species are those that are characteristic of the genus, viz., oxyhexasters with elongate principals and plumicomes.

The oxyhexasters (pl. IX, fig. 2) occur in abundance. Diameter 80—99 μ (infrequently measures up to 115 μ), mostly 99 μ. The principals are slender and 14—19 μ long (in Specimen C,

they measure 17—24 μ); they are quite or nearly smooth, at most very faintly rough and nearly prickly. The smooth or obsoletely rough and uniformly attenuating terminals are 23—34 μ long (in Specimen C, they measure up to 50 μ) and may be said to be at least about as long as the principal, generally decidedly longer and even nearly twice as long as the principal, instead of being only half as long as should be the case in *L. philippinensis*. Usually there are two terminals to each principal, making an angle of about 60° with each other. Seldom three, and much more rarely four, terminals occur to a principal. Hemihexactinoid forms were met with only once or twice. In Specimen C I met with a few cases of discohexasters, 40—50 μ diameter and looking very much like those of *Lanuginella pupa* (Ijima, 1904, Contrib. IV, pl. I, fig. 11). Each moderately long principal with three terminals and five disc claws.

The plumicomes (pl. IX, fig. 3) are extremely rare and their terminals so exceedingly delicate and transparent that it requires a prolonged careful search in order to bring the spicules under observation. I have found several of them in both specimens of the sponge, without, however, having been able to determine their exact position, except in one case which was met with near the gastral surface. Nor have I been able to make their minute examination owing to the manner of mounting which prevented the application of a high power of the microscope. Nevertheless, the shape and structure seemed to agree well with F. E. SCHULZE's figure (Chall. Rep., pl. LIV) and description (F. E. SCHULZE 1897, Rev.) of the same rosette for *L. philippinensis*. Only the size is decidedly smaller than in that species; for, whereas the diameter is given at 60—70 μ for *L. philippinensis*, the same in *L. suluanus* is only about 35 μ. The central cross of the slender principals measures in axial length only about 10 μ (11 μ in Specimen C, the capitulum inclusive). In Specimen C, plumicomes were very abundant in the parts adjoining the gastral surface. Central cross and berry-like capitulum very distinct, quite as depicted by F. E. SCHULZE. Size: 27—35 μ dia., notwithstanding the fact that many other spicules are larger in C than in A.

Remarks. — Of the two species hitherto known of the genus *Lophocalyx*, *L. spinosa* F. E. Sch. of the Bay of Bengal is clearly a distinct form, while as regards *L. philippinensis* (Gray) of the Philippines doubts may be entertained if it is really specifically separable from the present species, the two being essentially so much alike. Whatever results future investigations may lead us to, the tangible differences in their spiculation, as pointed out in the above description, are, I believe, a sufficient warrant to hold them distinct for the present at least.

L. philippinensis, originally known from the Philippines (near Cebu, 174 m.), has been reported by F. E. SCHULZE to have been also obtained by the "Challenger" near Little Ki Island (Chall. Stat. 192, Lat. 5°49′15″ S., Long. 132°14′15″ E.; depth 236 m.) at nearly the same locality as that which yielded specimens C and D of *L. suluanus* (Chall. Rep. p. 133 & F. E. S., 1897, Rev. d. Syst. d. Asco. & Ross., p. 546). The "Challenger" specimens referred to were all very young (small) and spherical or ovoid in shape, showing as yet no prostalia of any kind. F. E. SCHULZE does not give a special account of their spicules. It appears to me very likely that those specimens should be referred to *L. suluanus* rather than to *L. philippinensis*, provided of course the two are kept distinct. If I am right in this supposition, the locality of the latter species, as known at present, should be restricted to the Philippine waters.

Subfamily b. Rossellinae F. E. Schulze, 1897.

Rossellinae, F. E. Sch., 1897, p. 532. — Ijima, 1898, p. 45; 1904, p. 16.

Hypodermalia commonly pentactins only, less frequently pentactins and rhabdodiactins, or rhabdodiactins only. Choanosomal megascleres hexactins and rhabdodiactins, but sometimes the latter only. Hexasters as a rule oxyhexaster and discohexaster; the latter often in more than one variety, but may also be totally absent.

A list of genera and species and a key to the genera are given in Ijima, 1904, pp. 16—19, so far as were known at the time. Another key to the genera has been published by F. E. Schulze, 1904, p. 176. Since then, five new genera have been added to the subfamily, as follows: *Aulorossella* Kirkp., 1907, *Anaulosoma* Kirkp., 1907, *Anoxycalyx* Kirkp,, 1907, *Gymnorossella* Tops., 1916, and *Scolymastra* Tops., 1916.

Genus **Bathydorus** F. E. Sch., 1886.

Bathydorus F. E. Sch., 1886, p. 150, p. 376; Ldfd., 1915, p. 94.

Diagnosis. — Rossellinae with thick-walled, sac-shaped, calyculate or lamellar body with oxyhexasters, sometimes with hemioxyhexasters and devoid of microsclers in choanosome. Hypodermal pentactins mostly present. Dermal spicules chiefly tetractins (stauractins), more usually with 1—3 rays, or rarely with 5 or 6. Gastral spicules hexactins, their distal ray may be differentiated so as to render them somewhat pinular.

1. *Bathydorus pedunculatus* n. sp. (Pl. IX, figs. 15—17).

Stat. 122. 1° 58′.5 N., 125° 0′.5 S. 1264—1165 m. One fragment.

Diagnosis. — Sponge with long tubular stalk, firmly attached by the lower end. Stalk of a finely fibrous texture; compact but without ankylosis among the spicules. Megascleric parenchymalia exclusively slender diactins. Autodermalia rough pentactins, with rays 60—150 μ long. Hypodermal pentactins absent. Gastralia unknown. Hexaster of single kind, viz., hemioxyhexasters of 50—65 μ diameter, in which 1—5 principals may be uniterminal, the rest bearing 2—4 terminals each.

Description. — At Station 122 (off northern end of Celebes) the "Siboga" Expedition obtained the fragmentary specimen on which this new species is based. It represents evidently only the long tubular stalk (pl. IX, fig. 17) of an individual, the body proper of which had been torn off and lost apparently at the point of its junction with the stalk. Nothing definite can therefore be stated about the shape of the entire sponge, any further than that it must have been a tall stalked form growing upon a firm substratum.

The stalk [1]) was about 150 mm. long and 5—7 mm. thick in the greater part of its

1) By inexcusable oversight of my attendants, the specimen was thrown, it seems, among the laboratory rubbish and has thus got irretrievably lost, to my great regret. Fortunate however in so far as some figures and preparations were made and notes taken of the specimen before the loss took place.

length. The lower end was broadened into a knobby base with uneven attachment-surface that measured about 16 mm. across, while at the upper end there opened the lumen of the tubular stalk by a wide aperture, around which the torn edge of the wall was rather loosely textured and somewhat felt-like. In the stalk proper it was finely and densely fibrous in longitudinal direction, giving it a firm, but not rigid, consistency. Nowhere in the stalk, except presumably in the region of the basal attachment-surface (basidictyonalia), there seemed to exist fusion between the spicules. The stalk lumen was simple and wide, the wall being of only a moderate thickness; it extended right through the stalk, probably to close upon the inferior extremity of this. No opening, other than that at the upper end of the stalk lumen, was to be seen on the entire specimen.

Spiculation. — The megascleric parenchymalia are exclusively diactins of comparatively fine calibers. While the thinner diactins (as thin as 7,50 μ) are indistinguishable from those that ordinarily form comitalia, the larger ones — i. e., the tignules — may reach a length of 2,50 mm. and a breadth of 50 μ in the broadest part. These are nearly straight or very gently curved and are without any external indication of the spicular center; they taper but gently towards both ends, which are invariably rounded and are thickly beset with rather prominent conical microtubercles for a length of about 45 μ at most. (Some uncinates met with in the preparations, I consider to be certainly of extrinsic origin).

The autodermalia (pl. IX, fig. 18) are predominantly rough pentactins and occasionally stauractins, with rays 60—150 μ (generally about 114 μ) long and about 7,50 μ thick at base. The rays taper but little towards the end, which is either rounded or obtusely conical. The roughness of their surface is somewhat faint, being caused by spiny microtubercles that occur a little crowdedly at the ray end but for the rest at rather wide intervals. Needless to say that in the pentactine forms the unpaired ray is directed proximally. The plane of the cross of paratangentials is nearly flat or slightly conically convex on the outer side. The autodermalia were found abundantly but in irregular distribution in the uppermost parts of the specimen. They were entirely absent on the stalk proper.

Special pentactins that could be called hypodermalia were not discovered; it may be that their place is taken by diactins indistinguishable from the megascleric parenchymalia.

Special gastralia were likewise undiscoverable in the preparations made of the specimen.

The only hexasters present are small hemioxyhexasters (pl. IX, fig. 19) of 50—65 μ diameter, in which one or more, sometimes as many as five, principals are uniterminal. The principals are not very short; they may be 8 μ long by a breadth of about 3,50 μ. Unless uniterminal each principal bears 2—4, strongly divergent, moderately strong and uneven-surfaced terminals of 22—28 μ length. A uniterminal ray may sometimes show a bending at the junction of the principal with the terminal. The total number of terminals in one and the same hexaster is most commonly 11—15. A case in which one principal was provided with three terminals and the rest with one each — thus making the total number of terminals 8 — was the one that showed the least number of terminals. Neither monoxyhexaster nor holoxyhexaster was observed with certainty. The above hexaster is common in the parenchyma of the upper parts of the specimen. I have not determined if it occurred in equal abundance in the lower parts of the stalk.

Remarks. — The exclusively diactine character of the megascleric parenchymalia and

the fact that the hexaster is represented by oxyhexasters only, have led me to refer this new species to the Rosselline genus *Bathydorus*. One not unimportant point in the spiculation, that interferes in a degree with a ready acceptance of this view, is the apparent absence of pentactine hypodermalia which are known to exist in all the hitherto known species [1]) of *Bathydorus*. Another point that seems also to require consideration in this relation is the presence of the long tubular stalk, which has never yet been recorded from the genus. The characters indicated give it an isolated position in the genus. Whether or not its generic separation is necessary may well be left for the future to decide.

Subfamily c. Acanthascinae F. E. Sch., 1897.

Acanthascinae, F. E. Sch., 1897, p. 532. — Ijima, 1898, p. 52; 1904, p. 127.

Sacciform or vase-like, moderately thick-walled, often laterally compressed. Hypodermalia pentactins, or pentactins and rhabdodiactins, rarely rhabdodiactins only. Choanosomal megascleres exclusively rhabdodiactins. Hexasters represented by oxyhexaster and discohexaster; the latter generally in two varieties: the discoctaster which is invariably present, and the microdiscohexaster which may sometimes be wanting.

Comprising three genera: *Acanthascus* F. E. Sch., 1886, *Rhabdocalyptus* F. E. Sch., 1886, and *Staurocalyptus* Ij., 1897. For a key to them, see Ijima, 1904, p. 128, or F. E. Schulze, 1904, p. 177.

Genus **Staurocalyptus** Ijima, 1897.

Staurocalyptus Ijima, 1897, p. 53; 1904, p. 162. — v. Ldfd., 1915, p. 112.

Diagnosis. — Hypodermalia include pentactins in which the paratangentials are smooth or rough, but never armed with spines. Generally veiled, sometimes not.

1. *Staurocalyptus celebesianus* n. sp. (Pl. IX, figs. 10—14).

Stat. 122. 1° 58′.5 N., 125° 0′.5 S. 1264—1165 m. One specimen.

Diagnosis. — Staurocalyptus with slender stauractin autodermalia, generally 100—114 μ in length of ray. Prostalia and hypodermalia large, smooth-rayed paratropal pentactins, in which paratangentials may reach a length of 13 mm. Autogastralia oxyhexactins with free proximal ray 450 μ or over in length. Oxyhexaster with principals that have nearly disappeared, at most two slender terminals to a principal; generally hemihexasterous, quite rarely hexactinoid or holohexasterous, mostly 130—150 μ in diameter. Discoctaster mostly 198—230 μ in diameter, without bosses on centrum; 5 or 6 terminals in a narrow gradually expanding tuft and terminal knob minute and indictinct. Microdiscohexaster under 19 μ diameter, sparsely present in peripheral parts.

1) *B. baculifer*, *B. fimbriatus*, *B. laevis*, *B. spinosus*, *B. stellatus* and *B. uncifer*, all described by F. E. Schulze.

Description. — Station 122, off northern extremity of Celebes, has yielded a small specimen of *Staurocalyptus* which is here made into a new species under the name of *S. celebesianus* (pl. IX, figs. 10—14). It is in a bad state of preservation and represents a flatly collapsed tube, 72 mm. long and 27 mm. broad. From the fact that the lower end is somewhat contracted I presume that it was torn away from near the base. The wall at the upper end is very thin, while in the lower parts it is at places 2.5 mm. thick. The external surface, from which the autodermal layer has nearly entirely fallen off as a result of laceration, shows incurrent canal apertures measuring not over 1 mm. across and also some short projecting fibers, either isolated or in small tufts. Without doubt most of these fibers are remnants of the broken shafts of prostal pentactins; others may be same of prostal diactins. Of the pentactine prostals a few were found which still preserved their filament-like paratropal paratangentials. The gastral surface is covered over by a continuous autogastral layer, through which are visible the excurrent canal apertures, on the whole larger than the incurrent apertures of the external side. As a matter of fact the specimen presents macroscopically no points that are strikingly characteristic.

Spiculation. — The principal parenchymalia are thin and long diactins of quite the usual appearance and arrangement. A large spicule of the kind may be 15 mm. long and 30 μ thick in the middle.

The hypodermalia — or the veil-forming prostalia after protrusion through the autodermal layer — are slender-rayed paratropal pentactins of moderately larger size. The paratangentials reach a length of 13 mm. by a thickness of nearly 65 μ in the basal parts, while the proximally directed shaft-ray accompanied by slender diactin comitalia is much shorter — only 7 mm. long in one case. All the rays are smooth on the surface, except perhaps at the very tip which, being broken off in all the spicules examined, did not come under my observation.

The autodermalia (pl. IX, fig. 12), so far as I have seen, are all stauractins. They are rather slender rayed, faintly rough all over and slightly concave on the inner side. The rays, 100—114 μ long as measured from the center and about 6 μ thick at base, gradually taper towards the bluntly pointed end. At places I have seen the spicules forming a delicate quadrate-meshed autodermal latticework, in which the sides of the meshes are, as usual, about as long as the length of the spicular rays.

The autogastralia (pl. IX, fig. 13) are oxyhexactins of a moderately large size, with rough tapering rays. Thickness of rays at base, 7.5—9.5 μ. Length of free proximal ray, 400—450 μ, sometimes even 550 μ. That of paratangentials, generally 180—230 μ. Distal ray on the whole somewhat shorter than, or nearly as long as, the paratangential of the same spicule. The proximal ray, besides being the longest, is further characterized by the fact that the microtubercles, which are almost obsolete on all the other rays, are on it perceptibly better developed and are directed obliquely away from the spicular center. As before indicated the autogastralia form a continuous quadrate-meshed latticework lining the inner surface of the wall.

The oxyhexasters (pl. IX, fig. 11) are mostly hemihexasterous, that is to say, some of the six principals have only one terminal each. On the other hand, both strictly hexactinoid and holohexasterous oxyhexasters are rather rare. Diameter, mostly 130—150 μ. The principals are exceedingly short, or nearly non-existent as such. They are either uniterminal or bear but

two divergent terminals, so that the total number of these in an oxyhexaster usually stands between six and twelve. The terminals are slender, faintly rough, nearly straight except at origin and not quite smooth throughout; they may be 75 μ long. The oxyhexasters occur in great abundance. Those of the peripheral parts seem to be indistinguishable from those lying in the deeper parts.

The octasters (pl. IX, fig. 14) occur in moderate abundance. Here again I can make no distinction between those lying in the peripheral and the deeper parts. They are generally 198—230 μ in diameter, mostly about 210 μ. The centrum shows no boss-like tubercles in the spaces enclosed by the origin of every four principals; on the contrary, those spaces are somewhat concave. The smooth principals, which take up about $^1/_3$ the length of the entire ray, slightly broaden towards their outer end, to a thickness of about 11 μ; they contain a certain number of small vacuities, as does also the centrum. To each principal there are 5 or 6 (rarely 4 and usually 5) terminals, forming a tuft which gently broadens outwards to a breadth of 23—30 μ. Each terminal is nearly smooth, gradually tapering, and moderately straight after starting. The terminal knob is of quite insignificant size and so little pronounced that under low powers of the microscope the terminals appear as if they were simply bluntly pointed at the tip.

The microdiscohexaster was observed in limited numbers on or near the dermal surface. None were in a condition fit for close observation; however, I may say that they seemed to be spherical in shape and of the usual appearance, not quite to reach 19 μ in diameter. The cross formed by the principals, with capitulum at the end of each, could be distinctly seen, measuring about 9 μ in axial length.

Remarks. — Of all the known *Staurocalyptus* species, there are three which, like the present species, have either exclusively or predominantly stauractins for their dermalia. They are *S. glaber* Ij., *S. heteractinus* Ij. and *S. microchetus* Ij. All these are however of so markedly different characteristics as compared with the species here described that the specific distinctness of the latter is apparent. Very close is the new species to certain other *Staurocalyptus*, as e. g. *S. dowlingi* (Lambe) and *S. affinis* Ijima, but the fact, that the dermalia are stauractins, instead of pentactins, assures the specific independence of the Celebes specimen.

III. LIST OF SIBOGA STATIONS AT WHICH HEXACTINELLIDS WERE OBTAINED, WITH MENTION OF THE FORMS COLLECTED AT EACH.

No.	STATION	DEPTH IN M.	NATURE OF THE BOTTOM	SPECIES	NUMBER OF SPECIMENS
12	7°15′ S., 115°15′.6	289	Mud and broken shells	1. Indeterminable *Farrea*	One fragment
				2. Indeterminable *Eurete* or *Pararete*	
				3. *Aphrocallistes beatrix* Gray	One specimen
15	7° 2′.6 S., 115°23′.6	100	Fine coral sand	1. *Pararete baliense* n. sp.	Several specimens
				2. *P. kangeanganum* n. sp.	Three fragments
52	9° 3′.4 S., 119°56′.7	959	Globigerina ooze	1. *Hyal. (Cyliconema) apertum maehrenthali* F. E. Sch.	
				2. *Hyalonema* sp. (a basal needle)	
59	10°22′.7 S., 123°16′.5	390	Coarse coral sand with small stones	1. Indeterminable *Eurete* or *Pararete*	
				2. *Aulocystis zitteli zitteli* (Marsh. & Mey.)	One fragment
				3. *Chaunoplectella steletta* n. sp.	One specimen
				4. Indeterminable Euplectellid	One fragment
89	Pulu Kaniungan Ketjil	11	Coral	1. Indeterminable Farrea	One specimen & fragment
				2. *Hexactinella vermiculosa* n. sp.	
				3. *Sclerothamnus clausi* Marsh.	Fragments
90	1°17′.5 N., 118°53′	281	Coral, Sand and Stones	1. *Farrea nodulosa* n. sp.	One fragment
				2. *Pararete freeri* n. sp.	One fragment
				3. *Hexactinella vermiculosa* n. sp.	One fragment
94	5°11′.2 N., 119°35′.4	450	Apparently sand and stone	1. Indeterminable *Eurete* or *Pararete*	
95	5°43′.5 N., 119°40	522	Stony bottom	1. *Farrea nodulosa* n. sp.	One fragment
				2. *Pararete freeri* n. sp.	One specimen & fragment
				3. Indeterminable *Eurete* or *Pararete*	
				4. *Tretodictyum tubulosum* F. E. S.	One fragment
				5. *Aphrocallistes beatrix* Gray	Fragments
				6. Indeterminable Euplectellid	One fragment

No.	STATION	DEPTH IN M.	NATURE OF THE BOTTOM	SPECIES	NUMBER OF SPECIMENS
97	5° 48′.7 N., 119° 49′.6	564	Coarse coral sand	1. *Pararete farreopsis farreopsis* (Cart.)	Fragments
				2. *P. farreopsis jakosalemi* n. subsp.	Three specimens
				3. *P. freeri* n. sp.	One specimen & fragments
				4. Indeterminable *Eurete* or *Pararete*	
				5. *Myliusia verrucosa* n. sp.	Three specimens
				6. ?*Aulocystis* sp.	One fragment
				7. *Lophocalyx suluanus* n. sp.	Two specimens
100	6° 11′ N., 120° 37′.5	450	Dead coral	1. *Pararete freeri* n. sp.	Fragments
105	6° 8′ N., 121° 19′	275	Coralbottom	1. *Farrea nodulosa* n. sp.	Fragments
				2. *Eurete freelandi* n. sp.	Two fragments
				3. Indeterminable *Eurete* or *Pararete*	
				4. *Aphrocallistes beatrix* Gray	Fragments
				5. *Tretorete incertum*, n. sp.	Three specimens
				6. *Aulocystis zitteli zitteli* (Marsh. & Mey.)	One fragment
119	1° 33′.5 N., 124° 41′	1901	Stony bottom	1. *Farrea occa ouwensi* n. subsp.	One specimen & fragment
122	1° 58′.5 N., 125° 0′.5	1264	Stone	1. *Sericolophus reflexus* Ij.	Two specimens
				2. *Semperella similis* n. sp.	Two specimens
				3. *Farrea occa erecta* n. subsp.	Fragments
				4. *F. occa ouwensi* n. subsp.	One specimen
				5. *Regadrella cylindrica* n. sp.	Three specimens
				6. *Bathydorus pedunculatus* n. sp.	One fragment
				7. *Staurocalyptus celebesianus* n. sp.	One specimen
124	2° 27′ N., 125° 35′	1327	Stone	1. *Farrea occa ouwensi* n. subsp.	One specimen & fragments
137	0° 23′.8 N., 127° 29′	472	Fine, dark muddy sand	1. *Hyal. (Cylico.) apertum maehrenthali* F. E. S.	One specimen
145	0° 54′ S., 128° 39′.9	827	Hard. Pumice-stone	1. *Sericolophus reflexus* Ijima	Two specimens
				2. *Hyal. (Pteronema) topsenti* n. sp.	Two specimens
				3. *Hyal. (Cyliconema) apert. maehrenthali* F. E. S.	One specimen
				4. *Farrea occa cuspidata* n. subsp.	Three specimens
				5. *Aphrocallistes beatrix* Gray	Fragments
156	0° 29′.2 S., 130° 5′.3	469	Coarse sand and broken shells	1. *Farrea occa cuspidata* n. subsp.	Several specimens
				2. *Pararete farreopsis fragiferum* n. subsp.	Two specimens
				3. Indeterminable *Eurete* or *Pararete*	
				4. *Periphragella irregularis* n. sp.	Seven specimens
				5. *Sclerothamnus clausi* Marsh.	Fragments
159	0° 59′.1 S., 129° 48′.8	411	Coarse sand	1. Indeterminable *Eurete* or *Pararete*	
				2. *Sclerothamnus clausi* Marsh.	One fragments
				3. *Aphrocallistes beatrix* Grey	Fragments

No.	STATION	DEPTH IN M.	NATURE OF THE BOTTOM	SPECIES	NUMBER OF SPECIMENS
161	1° 10′.5 S., 130° 9′	798	Muddy sand	1. *Hyal. (Cylicò.) apertum maehr.* F. E. S.	One specimen
173	3° 27′ S., 131° 0′.5	567	Fine, yellow grey mud	1. *Hyal. (Cylico.) apertum maehr.* F. E. S.	One specimen
177	2° 24′.5 S., 129° 38′.5	1633	Dead coral and stones, covered with manganese	1. *Farrea occa erecta* n. subsp. 2. *Lefroyella ceramensis*, n. sp. 3. *Aphrocallistes beatrix* Gray 4. *Bolosoma cavum* n. sp.	Fragments One specimen Two specimens One specimen
208	5° 39′ S., 122° 12′	1886	Solid green mud	1. *Hyal. (Cylico.) apertum maehr.* F. E. S.	Two specimens
210a.	5° 26′ S., 121° 18′	1944	Gray mud, upper layer more liquid and brown; Pumice-stone	1. *Hyal. (Coryno.) rotundum* n. sp.	One specimen
211	5° 40′.7 S., 120° 45′.5	1158	Coarse grey mud, superficial layer more liquid and brown	1. *Hyal.* sp. (Basal fibers)	Fragments
215a.	1300 M. distant from North point of Kabia Island	500	Stone	1. *Farrea* indeterminable	Fragment
220	West coast of Binongka	278	Coral sand	1. *Farrea occa erecta* n. subsp.	One specimen
221	6° 24′ S., 124° 39′	2798	Solid bluish grey mud with foraminifera	1. *Hyal. (Lepto.) flagelliferum* n. sp. 2. *Hyal. (Thamno.) thamnophorum* n. sp. 3. *Hyalonema* sp. (Root-tufts only of a remarkably great length)	One specimen Two specimens
226	5° 26′.7 S., 127° 36′.5	1595	Hard. Obtained none but some small stones in dredge	1. *Farrea occa erecta* n. subsp. 2. *F. occa clavigera* n. subsp. 3 *F. occa ouwensi* n. subsp. 4. *Lefroyella ceramensis* n. sp. 5. *Sclerothamnopsis schulzei* n. sp. 6. *Psilocalyx wilsoni* n. sp. 7. *Aphrocallistes beatrix* Gray 8. *Tretopleura candelabrum* n. g., n. sp. 9. Indeterminable Euplectellid 10 ?*Caulophacus* sp.	Fragments One specimen Four specimens Two specimens Fragments Fragments Fragments Fragments Fragments One fragment
251	5° 28′.5 S., 132° 0′.2	204	Hard coral sand	1. *Pheronema giganteum* F. E. S. 2. *Pheronema echinatum* n. sp. 3. *Chalaronema sibogae* n. g. n. sp. 4. *Hyal. (Cylico.) apert. maehr.* F. E. S. 5. *Farrea occa ouwensi* n. subsp. 6. *Eurete trachydocus* n. sp. 7. *E. schmidti treubi* n. subsp. 8. *E. sch. kampeni* n. subsp.	One specimen One specimen Two specimens One specimen One specimen One specimen Several specimens Two specimens

No.	STATION	DEPTH IN M.	NATURE OF THE BOTTOM	SPECIES	NUMBER OF SPECIMENS
251	5°28′.5 S., 132° 0′.2	204	Hard coral sand	9. *Pararete farreopsis farreopsis* (Cart.)	Numerous specimens
				10. *P. Semperi* (F. E. S.)	One specimen
				11. Indeterminable *Eurete* or *Pararete*	
				12. *Myliusia callocyathus* Gray	Four specimens & fragments
				13. *Tretodictyum schrammeni* n. sp.	Fragments
				14. *Hexactinella lata* (F. E. S.)	Fragments
				15. *Hex. lingua* n. sp.	Three specimens
				16. *Hex. ? spongiosa* n. sp.	Thirteen specimens
				17. *Anomochone expansa* n. g., n. sp.	Six specimens
				18. *A. globosa* n. g., n. sp.	Three specimens
				19. *Aphrocallistes beatrix* Gray	One specimen & fragments
				20. *Rhabdodictyum kurense* n. sp.	Seven specimens & fragments
				21. *Diapleura maasi* n. g., n. sp.	Twelve specimens
				22. *Leucopsacas scoliodocus* Ij.	One specimen
				23. Indeterminable Euplectellid	
				24. *Lophocalyx suluanus* n. sp.	Three specimens
253	5°48′.2 S., 132°13′	304	Grey clay, hard & crumbly	1. *Pheronema weberi* n. sp.	Several specimens
				2. *Hyal. (Cylico.) keiense* n. sp.	Fragments
254	5°40′ S., 132°26′	310	Fine, grey mud	1. *Hyal. (Euhyal.) keianum* n. sp.	Two specimens
				2. *Hyal. (Pteron.) topsenti* n. sp.	One specimen
				3. *Hyal. (Cylico.) apertum maehrentali* F. E. S.	One specimen
				4. Indeterminable *Hyalonema* (a basal stand)	
				5. *Eurete schmidti treubi* n. subsp.	One specimen
				6. *Pararete farreopsis farreopsis* (Cart.)	Two specimens
				7. Indeterminable *Eurete* or *Pararete*	
				8. *Hexactinella lata* (F. E. S.)	One fragment
				9. *Aphrocallistes beatrix* Gray	Fragments
256	5°26′.6 S., 132°32′.5	397	Greyish green mud	1. *Pheronema weberi* n. sp.	Fragments
				2. *Hyal. (Paradisc.) vosmaeri* n. sp.	One specimen
				3. *Aphrocallistes beatrix* Gray	One specimen & fragment
259	5°29′.2 S., 132°52′.5	487	Coral, sand and dead coral	1. Indeterminable *Farrea*	Several fragments
				2. *Eurete schmidti treubi* n. subsp.	One specimen
				3. Indeterminable *Eurete* or *Pararete*	
				4. *Tretodictyum schrammeni* n. sp.	One fragment
				5. *Diapleura maasi* n. g., n. sp.	One specimen & fragments
260	5°36′.5 S., 132°55′.2	90	Sand, coral and shells	1. *Eurete marshalli* F. F. S.	One specimen & fragments
				2. *Tretodictyum pumicosum* n. sp.	Four specimens

No.	STATION	DEPTH IN M.	NATURE OF THE BOTTOM	SPECIES	NUMBER OF SPECIMENS
260	5°36′.5 S., 132°55′.1	90	Sand, coral and shells	3. *Hexactinella rugosa* n. sp.	Fragments
				4. *Anomochone globosa* n. g., n. sp.	Fragments
				5. *Sclerothamnus clausi* Marsh.	Fragments
				6. *Aulocystis zitteli sibogae* n. sp.	Thirteen specimens
262	5°53′.8 S., 132°48′.8	560	Solid bluish grey mud, upper layer more liquid and brown mud	1. *Hyal. (Euhyal.) intermedium* n. sp.	One specimen
				2. *Farrea occa cuspidata* n. subsp.	Ten specimens
				3. *Eurete schmidti treubi* n. subsp.	One specimen
				4. Indeterminable *Eurete* or *Pararete*	
				5. *Tretodictyum schrammeni* n. sp.	Fragments
				6. *Hexactinella lingua* n. sp.	One specimen
				7. *Sclerothamnus clausi* Marsh.	Fragments
				8. *Aphrocallistes beatrix* Gray	One specimen
266	5°56′.5 S., 132°47′.7	595	Grey mud with coral and stones	1. *Farrea occa cuspidata* n. subsp.	Fragments
				2. *F. spirifera* n. sp.	Fragments
				3. Indeterminable *Farrea*	
				4. Indeterminable *Eurete* or *Pararete*	
				5. *Aphrocallistes beatrix* Gray	One specimen
267	5°54′ S., 132°56′.7	984	Grey mud with a brown upper layer	1. *Farrea occa subclavigera* n. subsp.	One specimen
				2. *F. occa cuspidata* n. subsp.	Two specimens
				3. *F. spirifera* n. sp.	Two specimens
				4. *F. lendenfeldi* n. sp.	Fragments
				5. Indeterminable *Farrea*	
				6. Indeterminable *Eurete* and *Pararete*	
				7. *Periphragella parva* n. sp.	Six specimens
				8. *Tretodictyum schrammeni* n. sp.	Fragments
				9. *Psilocalyx wilsoni* n. sp.	One specimen & fragments
				10. *Aphrocallistes beatrix* Gray	Fragments
271	5°46′.7 S., 134° 0′	1788	Bluish green mud of an uniform appearance	1. *Hyal.(Coscinonema)kirkpatricki* n. sp.	Three specimens
280	8°17.4′ S., 127°30′.7	1224	Dredge brought up glossy, black manganese nodules	1. *Farrea occa erecta* n. subsp.	Fragments
				2. *F. occa clavigera* F. E. S.	One specimen
				3. Indeterminable *Farrea*	One fragment
				4. *Aphrocallistes beatrix* Gray	Fragments
284	8°43′.1 S., 127°16.′7	828	Grey mud	1. *Sericolophus reflexus* Ij.	One specimen
				2. *Monorhaphis chuni* F. E. S.	One specimen
				3. *Hyal. (Cylico.) timorense* n. sp.	One specimen
				4. *Euplectella timorensis* n. sp.	Fragments
286	8°50′.2 S., 127° 2′.2	823	Mud, evidently a thin layer	1. ? *Pheronema giganteum* F. E. S.	One fragment
289	9° 0′.3 S., 126°24′.5	112	Mud, sand & shells	1. *Aulocystis zitteli sibogae* n. subsp.	Seven specimens
				2. *Leucopsacas scoliodocus* Ij.	One specimen
				3. *Euplectella timorensis* n. sp.	One fragment

No.	STATION	DEPTH IN M.	NATURE OF THE BOTTOM	SPECIES	NUMBER OF SPECIMENS
295	10°35′.6 S., 124°11′.7	2050	Fine grey mud 3 cm. thick, upper layer more liquid brown with black stripes	1. *Hyalonema* sp. (a root-tuft)	
297	10°39′ S., 123°40′	520	Soft, grey mud with brown upper layer	1. *Farrea occa mammillata* n. subsp. 2. *Eurete schmidti treubi* n. subsp. 3. *Pararete flabellatum* n. sp. 4. *Pleurochorium cornutum* n. sp. 5. *Tretodictyum schrammeni* n. sp.	Fragments Fragments One specimen Two specimens Fragments
300	10°48′.6 S., 123°23′.1	918	Fine grey mud	1. *Aphrocallistes beatrix* Gray 2. *Euplectella timorensis* n. sp. 3. *Bolosoma cavum* n. sp.	One fragment One specimen One specimen
305	Solor Strait	113	Stony	1. *Sclerothamnus clausi* Marsh. 2. *Aulocystis zitteli sibogae* n. sp.	Fragments One specimen
306	8°27′ S., 122°54′.5	247	Sandy mud	1. ? *Aulocystis* sp.	Fragment
312	8°19′ S., 117°41′	274	Fine sandy mud	1. *Aphrocallistes beatrix* Gray	Fragments
314	7°36′ S., 117°30′.8	694	Fine sandy mud	1. *Hyal. (Cylico.) apert. maehr.* F. E. S.	One specimen
316	7°19′.4 S., 116°49′.5	538	Fine dark brown sandy mud	1. *Hyal. (Cylico.) apert. maehr.* F. E. S.	One specimen

Two more localities where MACLEAR LADDS collected four species as following:

China Sea S. of Hainang	17°44′ N., 10°26′ E.	220		1. *Pararete farreopsis subglobosum* n. subsp. 2. *Tretodictyum tubulosum* F. E. S.	
Timor Sea	10°47′ S., 127°15′ E.	82		1. *Farrea hanitschi* n. sp. 2. *Aulocystis zitteli sibogae* n. subsp.	

IV. LIST OF RECOGNIZABLY KNOWN RECENT HEXACTINELLIDS ARRANGED SYSTEMATICALLY.

Suborder I. **AMPHIDISCOPHORA** F. E. Sch., 1899.

Fam. I. PHERONEMATIDAE J. E. Gray, 1870, emend.

Hyalonematidae F. E. Sch., partim, 1904.
Semperellidae F. E. Sch., partim, 1904, p. 181.

Genus I. **Pheronema** Leidy, 1868.

Holtenia Wy. Thomson, 1869, p. 112.
Pheronema Leidy, 1869, p. 9; F. E. Sch., 1886, p. 63; F. E. Sch., 1887, p. 239; F. E. Sch., 1887, p. 234; F. E. Sch., 1902, pp. 4, 5; F. E. Sch., 1904, p. 151.

1. *Ph. giganteum* F. E. Sch., 1886, near Little Kei Island (Small Moluccas); S. of Kur I. among the Kei Islands; off S. coast of eastern Timor.
2. *Ph. grayi* S. Kent, 1869, off Setubal in Portugal; Between Sicily and Italy; North Atlantic; Bay of Biscay; Azores; off the S. W. coast of Ireland.
3. *Ph. raphanus* F. E. Sch., 1894, (= *Ph. circumpalatum* F. E. Sch.); Andaman Is.; near Sumatra; Nicobars.
4. *Ph. hemisphaericum* Gray, 1873, Cebu, Philippine Is.; Singapore.
5. *Ph. globosum* F. E. Sch , 1886, near Little Kei I., Moluccas.
6. *Ph. carpenteri* (Wy. Thom.), 1869, North-eastern part of Atlantic; Brazilian coast; North Atlantic; N. W. of Scotland; Kirschengross to Faustgross; N. of Zanzibar (eastern coast of Africa).
7. *Ph. annae* Leidy, 1868, Santa Cruz (West Indies).
8. *Ph. weberi* n. sp., Kei Is.
9. *Ph. echinatum*, n. sp., South of Kur Island among the Kei Islands.
10. *Ph. gigas* (F. E. Sch.), 1886 N. of New Zealand between Ravul and Macauley Islands.

Genus II. **Poliopogon** W. Thoms., 1873.

Poliopogon W. Thoms., 1873, p. 29: F. E. Sch., 1886, p. 66; F. E. Sch., 1887, p. 254; F. E. Sch., 1894, p. 7; F. E. Sch., 1902, p. 4, 5.

1. *P. amadou* W. Thoms., 1873, South-west of Canary Is.

Genus III. **Sericolophus** (Ijima), 1894.

Sericolophus (Ijima), 1894, p. 366; Ijima, 1901, p. 128.

1. *S. reflexus* (Ijima), 1894, off northern extremity of Celebes; East of the southern end of the Moluccan Is., Halmaheira or Djilolo; South of the eastern end of Timor.

Genus IV. **Semperella** J. E. Gray, 1868.

Hyalonema Semper, 1868, p. 29.
Semperella J. E. Gray, 1868, p. 373; F. E. Sch., 1887, p. 259; F. E. Sch., 1904, p. 167.
Hyalothauma Herklots and Marshall, 1868, p. 435.
Meyerella J. E. Gray, 1872, p. 76.
Meyerina Carter, 1873, p. 275.

1. *S. schultzei* (Semper), 1868, Cebu, Philippines; Little Kei I.; Japan.
2. *S. similis* n. sp., off north end of Celebes.
3. *S. stomata* Ijima 1896, Sagami Bay, Japan.
4. *S. spicifera* F. E. Sch., 1904, Siberut-Street, Sumatra.
5. *S. cucumis* F. E. Sch., 1895, Vicinity of Andaman Is.; S. W. of Great Nicobar.

Genus V. **Platylistrum** F. E. Sch., 1904.

Platylistrum F. E. Sch., 1904, p. 165.

1. *P. platessa* F. E. Sch., 1904, N. of Zanzibar (East African coast).

Fam. II. MONORHAPHIDIDAE n. fam.

Genus I. **Monorhaphis** F. E. Sch., 1904.

Monorhaphis F. E. Sch., 1904, p. 167.

1. *M. chuni* F. E. Sch., 1904, N. of Zanzibar; S. of the eastern end of Timor Sea.
2. *M. dives* F. E. Sch., 1904, off Somali coast.
3. *M. fruticosum* (F. E. Sch.) 1893, W. of the Philippine Is., Luzon.

Fam. III. HYALONEMATIDAE J. E. Gray, 1857, emend.

Hyalonemadae J. E. Gray, 1857, p. 279.
Hyalonematidae F. E. Sch., 1904, p. 181.

Genus I. **Chalaronema** n. g.

1. *Ch. sibogae* n. sp., Kei Islands.

Genus II. **Hyalonema** J. E. Gray, 1832.

Hyalonema Gray, 1832, p. 79; F. E. Sch., 1886, p. 57; F. E. Sch., 1887, p. 189; F. E. Sch., 1904, p. 162; F. E. Sch., 1899, p. 94; Ldfd., 1915, p. 150.

Subgenus I. **Euhyalonema** n. subg.

1. *H.* (*Euhyalonema*) *sieboldi* (Gray), 1835, Sagami Bay, Japan.
2. *H.* (*Euhyalonema*) *intermedium* n. sp., Kei Is.
3. *H.* (*Euhyalonema*) *keianum*, n. sp., Kei Is.
4. *H.* (*Euhyalonema*) *proximum* (F. E. Sch.), 1904, Near Pageh-I.; Nias I. (W. coast of Sumatra).
5. *H.* (*Euhyalonema*) *pellucidum* (Ijima), 1894, off Sunosaki, Sagami Sea, Japan.

Subgenus II. **Pteronema** n. subg.

1. *H.* (*Pteronema*) *topsenti* n. sp., E. of the southern end of Halmaheira (Djilolo, one of the Moluccas).
2. *H.* (*Pteronema*) *cebuense* (Higgin), 1875, Cebu, Philip. Is.
3. *H.* (*Pteronema*) *aculeatum* (F. E. Sch.), 1894, Andamans, Indian Ocean.
4. (*Pteronema*) *globus* (F. E. Sch.), 1886, Banda Is., (Malay Archip.).
5. *H.* (*Pteronema*) *polycaulum*) (Ldfd.), 1915, Eastern tropical Pacific.
6. *H.* (*Pteronema*) *heideri* (F. E. Sch.), 1894, Andamans, Indian Ocean.

Subgenus III. **Coscinonema** n. subg.

1. *H.* (*Coscinonema*) *kirkpatricki* n. sp. West of Aru Is.
2. *H.* (*Coscinonema*) *toxeras* (W. Thoms.), 1877, Atlantic Ocean; near St. Thomas I., W. Ind.; near Grenada I., W. Ind.
3. *H.* (*Coscinonema*) *kenti* (O. Schm.), 1880, Gulf of Mexico; Caribbean Sea (West Indies).
4. *H.* (*Coscinonema*) *schmidti* (F. E. Sch.), 1899, Guadeloupe I., West Indies; N. E. coast of Brazil.
5. *H.* (*Coscinonema*) *conus* (F. E. Sch.), 1886, S. of Australia; W. of Tristan da Cunha (S. Atlantic).
6. *H.* (*Coscinonema*) *pateriferum* (H. V. Wilson), 1904, Entrance to Gulf of Panama; Mid-Pacific; Central and eastern parts of the tropical Pacific, including Gulf of Panama, the coast of northern Peru.
7. *H.* (*Coscinonema*) *lamella* (F. E. Sch.), 1900, S. W. of Cape Comorin.
8. *H.* (*Coscinonema*) *indicum* (F. E. Sch.), 1895, (= *Cosc. heymousi* F. E. Sch., possibly young *Cosc. indicum*); Laccadives; Arabian Sea, W. of India; Andamans; Bay of Bengal.
9. *H.* (*Coscinonema*) *indicum laccadivense* (F. E. Sch.), 1895, Andamans.
10. *H.* (*Coscinonema*) *indicum andamanense* (F. E. Sch.), 1895, Andamans.
11. ?(*Coscinonema*) *gracile* (F. E. Sch.), 1886, near Mindanao, Phil. Is.
12. ?*H.* (*Coscinonema*) *elegans* (F. E. Sch.), 1886, (= *Hyal. tenue* F. E. Sch.), from Mid-Pacific, near Christina I.; off the mouth of the Rio de la Plata (E. coast of S. America).

Subgenus IV. **Cyliconema** n. subg.

1. *H.* (*Cyliconema*) *apertum* (F. E. Sch.), 1886, (= *Stylocalyx apertum* F. E. Sch.; = *Hy. affine* (Marshall); = *Hy. affine japonicum* (F. E. Sch.), Japan; Andamans; W. Sumatra; Nicobars.
2. *H.* (*Cyliconema*) *apertum maehrenthali* (F. E. Sch.), S. of Munai Is. (Celebes); near Andaman Is.; N. W. of Kangeang Is. near Java; off E. end of Ceram; N. of Sumbawa; N. of Sumba; Kei Is; Halmaheira Sea; W. coast of Halmaheira Sea.
3. *H.* (*Cyliconema*) *pirum* (F. E. Sch.), 1895, Andamans, Indian Sea.
4. *H.* (*Cyliconema*) *tulipa* (F. E. Sch.), 1904, near Siberut I., W. of Sumatra.
5. *H.* (*Cyliconema*) *nicobaricum* (F. E. Sch.), 1904, Nicobar Is.
6. *H.* (*Cyliconema*) *nicobaricum nicobaricum* (F. E. Sch.), 1904, Nicobar Is.
7. *H.* (*Cyliconema*) *nicobaricum somalicum* (F. E. Sch.), 1904, Somali coast.
8. *H.* (*Cyliconema*) *molle* (F. E. Sch.), 1904, Zanzibar; Somali coast.
9. *H.* (*Cyliconema*) *coniforme* (F. E. Sch.), 1904, Somali coast.

10. *H.* (*Cyliconema*) *simile* (F. E. Sch.), 1904, Somali coast.
11. *H.* (*Cyliconema*) *valdiviae* (F. E. Sch.), 1904, S. W. of Great Nicobars.
12. *H.* (*Cyliconema*) *ovatum* (Ijima), 1895, (= *Cyl. ovatum ovatum* Ijima) Sagami Sea, Japan.
13. *H.* (*Cyliconema*) *rapa* (F. E. Sch.), Bay of Bengal; W. of Sumatra; near Nicobars.
14. *H.* (*Cyliconema*) *globiferum* (F. E. Sch.), 1904, S. W. of Great-Nicobars.
15. *H.* (*Cyliconema*) *timorense* n. sp., S. of the end of Timor.
16. *H.* (*Cyliconema*) *keiense* n. sp., Kei Is.
17. *H.* (*Cyliconema*) *drygalskii* (F. E. Sch.), 1910, Antarctic Sea.
18. *H.* (*Cyliconema*) *thomsonis* (Marshall), 1875, (= *Hyl. thomsonis exiguum* F. E. Sch.), N. of Shetland; W. of Hebrides; off Corogne; S.W. of Hebrides; S. of Thomsom Ridge; Azores.
19. *H.* (*Cyliconema*) *infundibulum* (Topsent), 1896, Near Flores I. (one of the Azores); Bay of Biscay; coast of Ireland.
20. *H.* (*Cyliconema*) *tenerum* F. E. Sch.), 1886, S. Pacific.
21. *H.* (*Cyliconema*) *martabanese* (F. F. Sch.), 1900, Bay of Martaban (Burma).

Subgenus V. **Paradisconema** n. subg.

1. *H.* (*Paradisconema*) *alcocki* (F. E. Sch.), 1895, near Laccadives.
2. *H.* (*Paradisconema*) *vosmaeri* n. sp., Kei Is.
3. *H.* (*Paradisconema*) *investigatoris* (F. E. Sch.), 1900, Bay of Bengal.

Subgenus VI. **Leptonema** Ldfd.

Leptonema Ldfd., 1915, p. 245.

1. *H.* (*Leptonema*) *campanula* Ldfd., 1915, Southern tropical Pacific.
2. *H.* (*Leptonema*) *divergens* (F. E. Sch.), 1886, Near Malden I., Middle Pacific.
3. *H.* (*Leptonema*) *urna* (F. E. Sch.), 1904, N. of Chagos Arch., S. of Maldive Is., Indian Ocean.
4. *H.* (*Leptonema*) *ovuliferum* (F. E. Sch.), 1899, off Pacific coast of Canada; Gulf of Panama.
5. *H.* (*Leptonema*) *flagelliferum* n. sp., S. E. of Binongka I. in Banda Sea.
6. *H.* (*Leptonema*) *acuferum* (F. E. Sch.), 1893, Torres Strait, near C. York.
7. *H.* (*Leptonema*) *lusitanicum* (B. d. Bocage), 1864, off the coast of Portugal; Bay of Biscay.
8. *H.* (*Leptonema*) *solutum* (F. E. Sch.), 1904, N. of Chagos Archipelago (middle of Indian Ocean).

Subgenus VII. **Thamnonema** n. subg.

1. *H.* (*Thamnonema*) *thamnophorum* n. sp., S. E. of Binongka I, in Banda Sea.

Subgenus VIII. **Phialonema** Ldfd.

Phialonema Ldfd., 1915, p. 358.

1. *H.* (*Phialonema*) *brevancora* Ldfd., 1915, Central tropical Pacific.

Subgenus IX. **Prionema** Ldfd.

Prionema Ldfd., 1915, p. 250.

1. *H.* (*Prionema*) *agujanum* Ldfd., 1915, (= *Hy. agujanum tenuis*, = *Pr. aguj. lata*), off northern Peru.
2. *H.* (*Prionema*) *azuerone* Ldfd., 1915, Eastern tropical Pacific.
3. *H.* (*Prionema*) *crassum* Ldfd., 1915, Eastern tropical Pacific.
4. *H.* (*Prionema*) *fimbriatum* Ldfd., 1915, Central tropical Pacific.
5. *H.* (*Prionema*) *pinulifusum* Ldfd., 1915, Eastern tropical Pacific.
6. *H.* (*Prionema*) *poculum* (F. E. Sch,), 1886, Valparaiso, near Juan Fernandes I.
7. *H.* (*Prionema*) *spinosum* Ldfd., 1915, Eastern tropical Pacific.
8. *H.* (*Prionema*) *validum* (F. E. Sch.), 1904, Zanzibar coast.

Subgenus X. **Corynonema** n. subg.

1. *H.* (*Corynonema*) *owstoni* (Ijima), 1894, Sagami Sea, Japan.
2. *H.* (*Corynonema*) *clathratum* (Ijima), 1894, Sagami Sea, Japan.
3. *H.* (*Corynonema*) *masoni* (F. E. Sch.), 1895, Bay of Bengal; Andaman Sea.
4. *H.* (*Corynonema*) *calix* (F. E. Sch.). 1904, S.W. of Surat-Passage.
5. *H.* (*Corynonema*) *weltneri* (F. E. Sch.), 1895, Laccadives in Arabian Sea.
6. *H.* (*Corynonema*) *clavigerum* (F. E. Sch.), 1886, near Penguin I.
7. *H.* (*Corynonema*) *populiferum* (F. E. Sch.), 1899, near San Clemente I., off the coast of S. California.
8. *H.* (*Corynonema*) *hercules* (F. E. Sch.), 1899, Galapagos Is.
9. *H.* (*Corynonema*) *grandancora* (Ldfd.), 1915, South-eastern tropical Pacific.
10. *H.* (*Corynonema*) *placuna* (Ldfd.), 1915, Central tropical Pacific.
11. *H.* (*Corynonema*) *tenuifusum* (Ldfd.), 1915, off Northern Peru.
12. *H.* (*Corynonema*) *tylostylum* (Ldfd.), 1915, off Northern Peru.
13. *H.* (*Corynonema*) *rotundum* n. sp., Entrance to gulf of Boni in Celebes.
14. ? *H.* (*Corynonema*) *depressum* (F. E. Sch.), 1886, N. of Mellish I. (N.-Pacific); Mid-Pacific.

15. ? *H.* (*Corynonema*) *cupressiferum* (F. E. Sch.), 1893, Mid-Pacific.

Subgenus XI. **Onconema** n. subg.

1. *H.* (*Onconema*) *obtusum* (Ldfd.), 1915, Eastern tropical Pacific.
2. *H.* (*Onconema*) *obtusum* var. *gracilis* (Ldfd.), 1915, Eastern tropical Pacific.
3. *H.* (*Onconema*) *obtusum* var. *robusta* (Ldfd.), 1915, Eastern tropical Pacific.
4. *H.* (*Onconema*) *agassizi* (Ldfd.), 1915, Eastern tropical Pacific.

Subgenus XII. **Oonema** Ldfd., emend.

Oonema Ldfd., 1915, p. 307.

1. *H.* (*Oonema*) *bianchoratum* (H. V. Wilson), 1904, off W. coast of Mexico; off the coast of Northern Peru.
2. *H.* (*Oonema*) *densum* Ldfd., 1915, Eastern tropical Pacific.
3. *H.* (*Oonema*) *henshawi* Ldfd., 1915, Eastern tropical Pacific.
4. *H.* (*Oonema*) *sequoia* Ldfd., 1915, Central tropical Pacific.
5. *H.* (*Oonema*) *crassipinulum* Ldfd., 1915, Central tropical Pacific.
6. *H.* (*Oonema*) *pedunculatum* (H. V. Wilson), 1904, About midway between the Galapagos and Acapules in Mexico.
7. *H.* (*Oonema*) *robustum* (F. E. Sch.), 1886, N. W. Pacific.

Subgenus XIII. **Skianema** Ldfd.

Skianema Ldfd., 1915, p. 376.

1. *H.* (*Skianema*) *umbraculum* Ldfd., 1915, Eastern tropical Pacific.
2. *H.* (*Skianema*) *aequatoriale* Ldfd., 1915, Eastern tropical Pacific.

Subgenus XIV. **Thallonema** Ldfd.

Thallonema Ldfd., 1915, p. 390.

1. *H.* (*Thallonema*) *geminatum* Ldfd., 1915, Eastern tropical Pacific.

Genus III. **Compsocalyx** F. E. Sch.

Compsocalyx F. E. Sch., 1904, p. 164.

1. *C. gibberosa* F. E. Sch., 1904, S. W. of Great Nicobars.

Genus IV. **Lophophysema** F. E. Sch.

Lophophysema, F. E. Sch., 1900, p. 19; F. E. Sch., 1902, p. 38.

1. *L. inflatum* F. E. Sch., 1900, Andaman Sea (W. of Andamans).

Suborder II. **HEXASTEROPHORA** F. E. Sch., 1899.

Tribe A. HEXACTINOSA Schram., 1910—1912.

Subtribe A. CLAVULARIA F. E. Sch., 1886.

Fam. I. FARREIDAE F. E. Sch., 1886.

Farreidae F. E. Sch., 1886, p. 69; F. E. Sch., 1887, pp. 266, 390; F. E. Sch., 1899 *a*, p. 109; F. E. Sch., 1904, p. 177.

Genus I. **Farrea** Bwbk., 1862.

Aulodictyon S. Kent, 1870, p. 249.
Farrea Carter, 1885, p. 387; F. E. Sch., 1886, p. 69; F. E. Sch., 1887, p. 266; F. E. Sch., 1902, p. 85; F. E. Sch., 1904, p. 142.

1. *F. occa occa* (Bwbk.), 1862, Sagami Sea, Japan; Cosmopolitan.
2. *F. occa clavigera* F. E. Sch., 1887, (= *F. clavigera* F. E. Sch., 1886), Banda Sea.
3. *F. occa claviformis* H. V. Wils., 1904, W. coast of Mexico.
4. *F. occa laminaris* Topsent, 1904, Azores.
5. *F. occa foliascens* Topsent, 1906, Azores, W. of Madeira.
6. *F. occa scutella* Ldfd., 1915, off S. coast of W. Panama.
7. *F. occa erecta* n. subsp., Banda Sea; Ceram Sea; Celebes Sea; off eastern end of Timor.
8. *F. occa subclavigera* n. subsp., Southern part of Great Kei I.
9. *F. occa cuspidata* n. subsp., S. end of Great Kei I. and Halmaheira Sea; off eastern end of Ceram.
10. *F. occa mammillata* n. subsp., off S. W. end of Timor.
11. *F. occa ouwensi* n. subsp., off the west of Menado, Celebes, Banda Sea, Kei Is.
12. *F. vosmaeri* F. E. Sch., 1886, Sagami Sea, Japan.
13. *F. sollasi* F. E. Sch., 1886, Sagami Sea, Japan.
14. *F. aculeata* F. E. Sch., 1899, S. W. of Cape Flattery, California.
15. *F. convolvulus* F. E. Sch., 1899, S. W. of Sandiego, California.
16. *F. mexicana* H. V. Wilson, 1904, Entrance to Gulf of Mexico.
17. *F. weltneri* Topsent, 1901 *b*, Azores.
18. *F. hanitschi* n. sp., N.E. of Melville Is.; Australia.
19. *F. nodulosa* n. sp., East coast of Borneo; Sulu I.
20. *F. spirifera* n. sp., near S. end of Great Kei I.
21. *F. lendenfeldi* n. sp., near S. end of Great Kei I.

Genus II. **Lonchiphora** n. g.

1. *L. inversa* n. sp., off east end of Timor.

Genus III. **Claviscopula** F. E. Sch., 1899.

Claviscopula F. E. Sch., 1899*a*, p. 109; Topsent 1904, p. 3.

1. *C. intermedia* F. E. Sch., 1899, (= *C. facunda pars* O. Schm., 1870), near St. Vincent I.

Genus IV. **Sarostegia** Topsent, 1904.

Sarostegia Topsent, 1904, p. 6; Dendy, 1916, p. 217.

1. *S. oculata* Topsent, 1904*a* [= *S. tubulosa* (F. E. Sch.)], near Cape Verde I.; Saya de Malha, Indian Ocean; W. coast of Sumatra.

Subtribe b. SCOPULARIA F. E. Sch., 1886.

Fam. I. EURETIDAE F. E. Sch., 1886.

Euretidae F. E. Sch., p. 70; F. E. Sch., 1887, pp. 289, 391.

Genus I. **Eurete** (Semper) 1868.

Eurete partim, F. E. Sch., 1886, p. 70; F. E. Sch., 1887, pp. 289, 392; F. E. Sch., 1904, p. 143.

1. *E. simplicissimum* Semper, 1868, Cebu, Philippine Is.
2. *E. bowerbanki* F. E. Sch., 1886, Sagami Sea, Japan.
3. *E. spinosum* Ldfd., 1915, off northern Peru.
4. *E. schmidti* F. E. Sch., 1886, Samboangan, Philippine Is.; Enoshima, Japan.
5. *E. schmidti treubi* n. subsp., Kei Is., S.W. end of Timor.
6. *E. schmidti kampeni* n. subsp. S. of Kur I., Kei Is.
7. *E. freelandi* n. sp., N. of Jolo I., near Pearl Bank, Sulu Archipelago.
8. *E. marshalli* F. E. Sch., 1886, near the Little Kei I.; W. of Great Kei I.
9. *E. trachydocus* n. sp., S. of Kur I., Kei Is.
10*. *E. erectum erectum* F. E. Sch., 1899, [= *E. erectum* A. Ldfd., = *Heterochone erecta* (F. E. Sch.)], Vicinity of Galapagos; Gulf of Panama.
11*. *E. erectum tubuliferum* H. V. Wilson, 1904, [= *E. erectum* B. Ldfd., = *Heterochone erecta tubuliferum* (Wils.)], N. border of the Gulf of Panama.
12*. *E. erectum gracile* H. V. Wilson, 1904, (= *E. erectum* C. Ldfd.), Entrance to the Gulf of Panama.
13*. *E. erectum* D. Ldfd., 1915, [= *Heterochone erecta* (F. E. Sch.)].
14*. *E. mucronatum* H. V. Wilson, 1904, N. border of the Gulf of Panama.
15**. *E. alicei* Topsent, 1901, Azores.

Genus II. **Pararete** n. g.

Eurete Carter 1877, Topsent, 1901*a*.
Eurete partim F. E. Sch., 1886, p. 70; F. E. Sch., 1887, p. 392; F. E. Sch., 1904, p. 143.

1. *P. farreopsis farreopsis* (Carter), 1877, near the Little Kei I.; Philippine Is.
2. *P. farreopsis fragiferum* n. subsp., Halmaheira Sea; Kei Is.
3. *P. farreopsis subglobosum* n. subsp. S. of Hainang, China Sea.
4. *P. farreopsis jakosalemi* n. subsp., near Pearl Bank, Sulu I.
5. *P. farreopsis baliense* n. subsp., S. of Kangeang I., Bali Sea.
6. *P. farreopsis kangeanganum* n. subsp., S. of Kangeang I., Bali Sea.
7. *P. freeri* n. sp., Pearl Bank, Sulu I.
8. *P. semperi* (F. E. Sch.), 1886, near the Little Kei I.
9. *P. carteri* (F. E. Sch.), 1886, near the Little Kei I.; Sagami Sea, Japan.
10. *P. gerlachei* (Topsent), 1901, Antarctic Ocean.

Genus III. **Pleurochorium** Schram., 1910—12.

Pleurochorium Schram., 1910—12, p. 251.

1. *Pl. cornutum* n. sp., S.W. end of Timor.
2. *Pl. amandelei* (Kirkp.), 1908, East and south coasts of Ceylon.

Genus IV. **Periphragella** Marsh., 1875.

Periphragella Marshall, 1875, pp. 177—180; Marshall, 1876, p. 123; F. E. Sch., 1887, pp. 299, 394.

1. *P. parva* n. sp., W.S. end of Great Kei Island.
2. *P. japonica* n. sp., (= *P. elisae* of Carter, 1885, and of F. E. Sch., 1886, 1887), Sagami Sea, Japan.
3. *P. elisae* Marshall, 1875, Moluccas.
4. *P. challengeri* n. sp., (= *P.* sp., of F. E. Sch., 1887, p. 304) off Little Kei I.
5. *P. lusitanica* Topsent, 1890, (= *Chonelasma schulzei* Topsent, 1890), near Flores I. (Azores).
6. *P. irregularis* n. sp., E. of Gagi I., Halmaheira Sea.

Genus V. **Lefroyella** W. Thomson, 1877.

Lefroyella W. Thoms., 1877, p. 403; F. E. Sch., 1887, p. 301.

Two series of the species indicated by one or two asterisks represent the forms which appear to show some differences in form of sufficient value to separate generically.

1. *L. decora* W. Thoms., 1877, (= *Syringidium zitteli* O. Schm., 1880; = *Dactylocalyx crispus* O. Schm., 1870), off Bermudas.
2. *L. ceramensis* n. sp., Ceram Sea; Banda Sea.

Genus VI. **Myliusia** J. E. Gray, 1859.

Myliusia J. E. Gray, 1859, p. 439, F. E. Sch., 1887, p. 352.

1. *M. callocyathus* J. E. Gray, 1859, W. Indies; Little Kei I.; St. Thomas, W. Indies; Sta Lucia; Barbados; Morro Light; S. of Kur Island.
2. *M. subglobosus* J. E. Gray, 1867, (= *Dactylocalyx subglobosus* Gray, 1867; = *Iphiteon subglobosa* Bwbk., 1869 = *Dactylocalyx subglobosa* Carter, 1873, not *D. subglobosus* O. Schmidt, 1880 and F. E. Sch., 1887), Sta Lucia (W. Indies); Malacca?
3. *M. conica* (O. Schmidt) 1880, Morro Light, West Indies.
4. *M. verrucosa* n. sp., near Pearl Bank, Sulu I.

Genus VII. **Margaritella** O. Schm., 1880.

Margaritella O. Schm., 1880, p. 54.

1. *M. coeloptychioides* O. Schm., 1880, near Porto Rico.

Genus VIII. **Chonelasma** F. E. Sch., 1886.

Chonelasma F. E. Sch., 1886, p. 76; F. E. Sch., 1887, p. 320.

1. *Ch. lamella* F. E. Sch., 1886, Kermadec I.; W. of Kerguelen I.
2. *Ch. lamella choanoides* F. E. Sch. and Kirkpatrick, 1910 (= ? *Uncinatera plicata* Tops. 1901 *b*), Antarctic Sea.
3. *Ch. ijimai* Topsent, 1901 *b*, Azores between Saô-Miguel and Terceira.
4. ? *Ch. calyx* F. E. Sch., 1886, Sagami Sea, Japan; W. coast of N. America from the Aleutians to the southern end of lower California; Gulf of Panama.
5. ? *Ch. tenerum* F. E. Sch., 1899 *a*, S. W. of San Diego, California.
6. ? *Ch. hamatum* F. E. Sch., 1866, Kermadec I.

Genus IX. **Ptychodesia** Schram., 1910—12.

Ptychodesia, Schram., 1910—12, p. 252.

1. *Pty. doederleini* (F. E. Sch.), 1886 (= *Chonelasma doederleini* F. E. Sch.), Sagami Sea, Japan.

Genus X. **Bathyxiphus** F. E. Sch., 1899.

Bathyxiphus F. E. Sch. and Kirkpatrick, 1901—1903, pp. 53—56; F. E. Sch., 1904, p. 178.

1. *B. subtilis* F. E. Sch., 1899, S. of Guadeloupe I.

Genus XI. **Heterorete** Dendy, 1916.

Heterorete Dendy, 1916, p. 214.

1. *H. pulchra* Dendy, 1916, Salomon.

Genus XII. **Dactylocalyx** Stutchbury, 1841.

Dactylocalyx Stutchbury, 1841, p. 86; F. E. Sch., 1886, p. 84; F. E. Sch., 1887, pp. 341—348.

1. *D. pumiceus* Stutchbury, 1841 (= *D. pumiceus* Sollas, 1879 = *D. pumicea* partim Gray, 1867, not *D. pumicea* from St. Vincent), Lesser Antilles; Barbados; Martinique.
2. ? *D. ingalli* Bwbk., 1869 (= *D. pumicea* partim Gray, 1867 = *D. ingalli* Bwbk., 1869 = ? *D. pumiceus* var. *stutchburyi*, Sollas, 1879, = ? *D. subglobosus*, O. Sch., 1880), W. Indies, St.. Vincent; Sta Lucia (Lesser Antilles).
3. ? *D. crispus* O. Schmidt, 1870, Cuba.
4. ? *D. potatorum* O. Schmidt, 1880, Portugal and S. W. of Bermudas.
5. ? *D. patella* F. E. Sch., 1887, off coast of Portugal and S. W. of Bermudas.

Genus XIII. **Iphiton** Bowerbank, 1869.

Iphiton Bwbk., 1869, p. 324.

1. *Iph. panicea* Bwbk., 1869, Porto Rico; Martinique.

Fam. II. TRETODICTYIDAE F. E. Sch., 1886.

Tretodictyidae F. E. Sch., 1886, p. 78; F. E. Sch., 1887, pp. 327, 398.

Genus I. **Tretodictyum** (F. E. Sch.), 1886.

Tretodictyum F. E. Sch., 1886, p. 78; Schrammen 1912, p. 225.

1. *T. tubulosum* (F. E. Sch.), 1886 (= *Hexactinella tubulosa* F. E. Sch.), Enoshima, Japan; Galapagos and Gulf of Panama; S. of Pearl Bank, Sulu I.; S. of Hainan, China Sea.
2. *T. schrammeni* n. sp., S.W. end of Timor; W. of Great Kei I.; S. of Kur I.; E. of Great Kei I.
3. *T. pumicosum* n. sp., W. of Great Kei I.

Genus II. **Hexactinella** Carter, 1885.

Hexactinella Carter, 1885, p. 387; F. E. Sch., 1887, p. 328; Schram., 1910—1912, p. 223.
Tretodictyum partim F. E. Sch., 1886, p. 78.

1. *H. ventilabrum* Carter, 1885 (= *Tretodictyum cyathus*, F. E. Sch., 1886 = *Hex.* str. *ventilabrum* Sch., 1912), Misaki, Enoshima, Japan; Gulf of Panama and the Galapagos.
2. *H. grimaldii* Topsent, 1890, N.W. of Spain; Azores.
3. *H. lata* F. E. Sch., 1886 (= *Tretodictyum latum* F. E. Sch., 1886 = *Tretodictyum latum*

Schramm. 1912), Little Kei I.; E. of Tajandu I., Banda Sea.
4. *H. rugosa* n. sp., W. of Great Kei I.
5. *H. vermiculosa* n. sp., E. coast of Borneo.
6. *H. lingua* n. sp., S. of Kur I., Banda Sea.
7. *H.* ? *spongiosa* n. sp., S. of Kur I., Banda Sea.
8. ? *H. labyrinthica* H. V. Wilson, 1904, Galapagos.

Genus III. **Auloplax** F. E. Sch., 1904.

Auloplax F. E. Sch., 1904, pp. 47, 48.
Dactylocalyx F. E. Sch., 1904, p. 45.
Joanella O. Schmidt, 1904, p. 50.
1. *A. auricularis* F. E. Sch., 1904, (= ? *Dactylocalyx patella* F. E. Sch., 1887), S. W. of Cape Bojador, W. coast of Africa.
2. *A. filholi* (Topsent), 1904, N. W. of Spain.

Genus IV. **Cyrtaulon** F. E. Sch., 1886.

Cyrtaulon F. E. Sch., 1886, p. 81; F. E. Sch., 1887, p. 332.
Volvulina O. Schm., 1880, p. 58.
1. *Cy. sigsbeei* (O. Schm.), 1880, Gulf of Mexico; Antilles.
2. *Cy. solutus* F. E. Sch., 1886, Little Kei I.

Genus V. **Tretocalyx** F. E. Sch., 1900.

Tretocalyx F. E. Sch., 1900*d*, p. 319.
1. *T. polae* F. E. Sch., 1900, Red Sea.
2. *T. monticularis* (Ldfd.), 1915, S. of Chatham I., Galapagos.

Genus VI. **Sclerothamnopsis** H. V. Wils., 1904.

Sclerothamnopsis H. V. Wilson, 1904, p. 84.
1. *Sc. compressa* H. V. Wilson, 1904, Galapagos.
2. *Sc. schulzei* n. sp. Lucipara and Schildpad I., in Banda Sea.

Genus VII. **Sclerothamnus** W. Marsh., 1875.

Sclerothamnus Marsh., 1875, p. 171; F. E. Sch., 1887, p. 337.
1. *Sc. clausi* W. Marsh., 1875, Philippines; near Banda I.

Genus VIII. **Psilocalyx** n. g.

1. *Ps. wilsoni* n. sp., Arafura Sea, E. of Great Kei I.; Schildpad & Lucipara I. in Banda Sea.

Genus IX. **Anomochone** n. g.

1. *A. expansa* n. sp., S. of Kur I., Banda Sea; W. of Great Kei I.
2. *A. globosa* n. sp., S. of Kur I., Banda Sea; W. of Great Kei I.

Fam. III. AULOCALYCIDAE n. fam.

Genus I. **Aulocalyx** F. E. Sch., 1886.

Aulocalyx F. E. Sch., 1886, p. 56; F. E. Sch., 1897, p. 543; Ijima, 1898, p. 43; F. E. Sch., 1904, p. 180.
1. *A. irregularis* F. E. Sch., 1886, off Marion I. (S.E. of the Cape of Good Hope); Antarctic Sea.
2. *A. serialis* Dendy, 1916, "Sealark", Indian Ocean; Saya de Malha.

Genus II. **Rhabdodictyum** (O. Schmidt), 1880.

Rhabdodictyum O. Schmidt, 1880, p. 370.
1. *Rh. delicatum* (O. Schmidt) 1880, Mexican Sea; Bequia (one of the Lesser Antilles); vicinity of Bermudas; Middle of S. Bay of Bengal.
2. *Rh. kurense* n. sp., S. of Kur I., Banda Sea.

Genus III. **Euryplegma** F. E. Sch., 1886.

Euryplegma F. E. Sch., 1886, p. 80; F. E. Sch., 1897, p. 545; Ijima, 1898, p. 44.
1. *E. auriculare* F. E. Sch., 1886, off Ravul I., N. E. of New Zealand.

Genus IV. **Fieldingia** S. Kent, 1870.

Fieldingia S. Kent, 1870, p. 219; Marshall, 1876, p. 124; F. E. Sch., 1887, p. 335.
1. *F. lagettoides* S. Kent, 1870, off coast of Portugal; Little Kei I.

Genus V. **Tretopleura** n. g.

1. *T. candelabrum* n. sp., between Schildpad and Lucipara I., Banda Sea.

Fam. IV. CRATICULARIDAE Rauff, 1893.

Craticularidae Rauff, 1893, p. 191.

Genus I. **Tretorete** n. g.

1. *T. incertum* n. sp., near Jolo Is., Sulu Arch.

Fam. V. APHROCALLISTIDAE J. E. Gray, 1867.

Aphrocallistidae J. E. Gray, 1867, p. 507; F. E. Sch., 1904, p. 178.
Mellittionidae Zittel, 1877, p. 417.

Genus I. **Aphrocallistes** J. E. Gray, 1858.

Aphrocallistes J. E. Gray, 1858, pp. 224—225; F. E. Sch., 1886, p. 74; F. E. Sch., 1887, p. 310; F. E. Sch., 1902, p. 87; F. E. Sch., 1904, p. 144.

1. *Aph. beatrix* Gray, 1858 (Included besides typical *beatrix*, P. Wrights' *bocagei* (1870), Topsent's *azoricus* (1901), and A. E. Sch.'s *ramosus* (1886) = a part of Ijima's (1916) *Aph. beatrix orientalis*), Bali Sea; Banda Sea; Kei Is.; off Timor Sea; Ceram Sea; Halmaheira Sea; Malacca; S. W. of Andamans; Cape Verde Is.; St. Paul (S. Indian Ocean); W. coast of Sumatra; Nicobars; off coast of Ireland; Sulu Sea.
2. *Aph. bocagei* (not P. Wright) F. E. Sch., 1886, English Channel; Cape Verde I.; Enoshima, Japan; Florida; coasts of Spain and Portugal; Antilles Is.; Atlantic coast of France; off Ascension I. (Mid-Atlantic); S. W. coast of Ireland; North Atlantic; near Andamans; S. W. of C. Comorin; off St. Thomas, W. Indies; Azores.
3. *Aph. azoricus* Topsent, (not 1901) 1904, Azores.
4. *Aph. ramosus* F. E. Sch., 1886, (= *Aph. beatrix orientalis* Ijima, 1916), Japan; Phil. Is.; W. of C. Bluff; Bay of Bengal.
5. *Aph. vastus* F. E. Sch., 1886, Sagami Bay, Japan; Philippine Is.; Unimak I. (Alaska); along the west coast of N. America from the Aleuthian Is. to the Bay of California; Cocos I.; Str. of Georgia.
6. *Aph. whiteavesianus* Lambe, 1892, Str. of Georgia.

Tribe B. LYCHNISCOSA Schram., 1903.

Fam. I. AULOCYSTIDAE F. E. Sch., 1866.

Aulocystidae F. E. Sch., 1886, p. 87; F. E. Sch., 1887, p. 356.

Genus I. **Aulocystis** F. E. Sch., 1886.

Aulocystis F. E. Sch., 1886, p. 87; E. F. Sch., 1887, p. 356.

1. *A. zitteli zitteli* (Marsh. & Mey.), 1877, Philippines; W. Indies; Little Kei I.; off Banda I. (Moluccas); Cebu, Philippine Is.; Guadeloupe; Barbados (W. Indies); S.E. of Taam I. (Kei I.); N.E. of Banda I.; Red Sea; Samau Strait.
2. *A. zitteli sibogae* n. subsp., S.E. coast of Timor; W. of Great Kei I.
3. *A. grayi grayi* (Bwbk.), 1869, Barbados, Guadeloupe; St. Vincent (West-Indies); Red Sea.
4. *A. grayi polae* n. subsp., (= *A. grayi* F. E. S., 1900*d*), Red Sea.

Fam. II. DIAPLEURIDAE n. f.

Genus I. **Diapleura** n. g.

1. *D. maasi* n. sp., S. of Kur I.; West of Great Kei I.

Tribe C. LYSSACINOSA Ijima.

Fam. I. LEUCOPSACASIDAE Ijima, 1903.

Leucopsacinae Ijima, 1898, p. 41.
Leucopsacidae Ijima, 1903, pp. 29—34, p. 110; F. E. Sch., 1904, p. 175.

Genus I. **Leucopsacas** Ijima, 1898.

Leucopsacas Ijima, 1898, p. 42; Ijima, 1903, p. 34, p. 110.
1. *L. orthodocus* Ijima, 1898, Sagami Sea, Japan.
2. *L. scoliodocus* Ijima, 1898, Sagami Sea, Japan; off coast of Ireland; S. of the eastern part of Timor; Kei Is.

Genus II. **Placopegma** F. E. Sch., 1896.

Placopegma F. E. Sch., 1896, p. 63; F. E. Sch., 1897, p. 544; Ijima, 1898, p. 4; F. E. Sch., 1902, p. 80; F. E. Sch., 1904; p. 137.
1. *P. solutum* F. E. Sch., 1896, Middle of Bay of Bengal; S. E. of Dar-es-Salaam, Indian Ocean.

Genus III. **Caulocalyx** F. E. Sch., 1886.

Caulocalyx F. E. Sch., 1886, p. 55; F. E. Sch., 1897, p. 548; Ijima, 1898, p. 44.
1. *C. tener* F. E. Sch., 1886, W. of Tristan da Cunha, Mid-south Atlantic.

Genus IV. **Chaunangium** F. E. Sch., 1904.

Chaunangium F. E. Sch., 1904, p. 31; F. E. Sch., 1904, p. 138.
1. *Ch. crater* F. E. Sch., 1904, S. W. of Great Nicobar.

Genus V. **Chaunoplectella** Ijima, 1896.

Chaunoplectella Ijima, 1896, p. 250; Ijima, 1898, p. 43; Ijima, 1903, p. 53, p. 111.
1. *Ch. spinifera* Ijima, 1903, Sagami Sea, Japan.
2. *Ch. stelleta* n. sp., W. entrance to Samar Strait, Timor.
3. *Ch. cavernosa* Ijima, 1896, Sagami Sea, Japan.

Fam. II. EUPLECTELLIDAE (Gray), 1903.

Euplectellidae F. E. Sch., 1896, p. 44; F. E. Sch., 1899, p. 96; Ijima, 1903, pp. 19, 108; F. E. Sch., 1904, p. 172; Ldfd., 1915, p. 20; F. E. Sch., 1902, p. 46.

Subfam. a. EUPLECTELLINAE Ijima, 1903.

Euplectellinae Ijima, 1903, pp. 26, 109.

Genus I. **Euplectella** Owen, 1841.

Euplectella Owen, 1841, pp. 3—5; Ijima, 1901, pp. 37—58; F. E. Sch., 1904, p. 132.

1. *E. aspergillum* R. Owen, 1841, Phil. Is., Cebu and Bohol, Philippines; Dar-es-Salaam and Zanzibar Canal, Indian Ocean; Cape St. Vincent, off Portugal.
2. *E. curvistellata* Ijima, 1901, Coast of Satoma.
3. *E. imperialis* Ijima, 1894, Sagami Sea; Suruga Bay, Japan.
4. *E. marshalli* Ijima, 1895, Sagami Sea; Suruga Bay, Japan.
5. *E. nobilis* F. E. Sch., 1904, S.W. of Cape Bojador (W. coast of Africa).
6. *E. oweni* Heck and Marsh., 1868, Kyushyu, Japan; Corean Channel.
7. *E. regalis* F. E. Sch., 1900, near Andamans.
8. *E. simplex* F. E. Sch., 1895, near Andamans; N. of Siberut (W. Sumatra); N. of Zanzibar, Indian Ocean.
9. *E. timorensis* n. sp., off the southern coast of Timor.
10. ? *E. aspera* F. E. Sch., 1895, Middle of the southernmost part of the Bay of Bengal; near the Laccadives.
11. ? *E. cucumer* R. Owen, 1887, Seychelles Is.
12. ? *E. crassistellata* F. E. Sch., 1886, North-west of the Caroline Is. (middle of the Pacific).
13. ? *E. jovis* O. Schm., 1886, Gulf of Mexico; near St. Lucia; near Grenada.
14. ? *E. nodosa* F. E. Sch., 1886, off Bermudas.
15. ? *E. suberea* W. Thomson, 1877, W. of Gibraltar; betw. Pernambuco and Bahia; off the Berlingues, N. Atlantic; Coast of Portugal, Brazil; N.W. Guadeloupe, W. Ind.; E. of Bahia; coast of Morocco; Pembakanal near Zanzibar; near Azores; S. W. of C. Bojador; S. E. of Cape St. Vincent; N. E. of the Rio San Francisco.

Genus II. **Holascus** F. E. Sch., 1886.

Holascus F. E. Sch., 1886, p. 39; F. E. Sch., 1887, p. 85; F. E. Sch., pp. 3—4; F. E. Sch., 1902, p. 46; F. E. Sch., 1904, p. 130; Ldfd., 1915, p. 20.

1. *H. fibulatus* F. E. Sch., 1886, West of Tasmania; half way between Kerguelen I. and coast of Good Hope; S. of Australia; between Edwards and Crozets Is., Indian Ocean; near Dar-es-Salaam (E. coast of Africa).
2. *H. stellatus* F. E. Sch., 1887, East of Monte Video (E. of Buenos Ayres).
3. *H. edwardsi* Ldfd., 1915, off the coast of Central Peru.
4. *H. obesus* F. E. Sch., 1904, N.E. of Enderby-land (S. Ind. Oc., near the Antarctic).
5. *H. polejaevi* F. E. Sch., 1886, S. of Australia.
6. *H. ridleyi* F. E. Sch., 1886, West of Mindanao.
7. *H. robustus* F. E. Sch., 1895, Bay of Bengal.
8. *H. tenuis* F. E. Sch., 1904, N.E. of Enderby-land (S. of Indian Ocean near the Antarctic Ocean).
9. *H. tener* F. E. Sch., 1895, Bay of Bengal.
10. *H. undulatus* F. E. Sch., 1899. W. of Prince Wales I.

Genus III. **Malacosaccus** F. E. Sch., 1886.

Malacosaccus F. E. Sch., 1886, p. 41; F. E. Sch., 1887, p. 91; F. E. Sch., 1895, pp. 12, 15.

1. *M. vastus* F. E. Sch., 1886, between Kerguelen I. and the Cape of Good Hope (S. of Ind. Oc.).
2. *M. floricomatus* Topsent, 1901, Azores.
3. *M. unguiculatus* F. E. Sch., 1886, S. of Sierra Leone; W. of Spain.
4. *M. pedunculatus* Topsent, 1910, Antarctic Ocean.
5. *M. coatsi* Topsent, 1910, Antarctic Ocean.

Genus IV. **Docosaccus** Topsent, 1910.

Docosaccus Topsent, 1910, p. 8; Topsent, 1913, p. 595.

1. *D. ancoratus* Topsent, 1910, Antarctic Ocean.

Genus V. **Acœlocalyx** Topsent, 1910.

Acoelocalyx Topsent, 1910, p. 5; Topsent 1913, p. 592.

1. *A. brucei* Topsent, 1910, Antarctic Ocean.

Genus VI. **Holascella** Ldfd., 1915.

Holascella Ldfd., 1915, p. 29.

1. *H. taraxacum* Ldfd., 1915, Eastern tropical Pacific.
2. *H. ancorata* Ldfd., 1915, Eastern tropical Pacific.
3. *H. euonyx* Ldfd., 1915, Eastern tropical Pacific.

Subfam. b. CORBITELLINAE Ijima, 1902.

Corbitellinae Ijima, 1902, p. 30; Ijima, 1903, p. 27.

Genus I. **Regadrella** O. Schm., 1880.

Regadrella O. Schm., 1880, p. 84; Ijima, 1901, pp. 220—222; F. E. Sch., 1904, p. 134.

1. *R. okinoseana* Ijima, 1896, Sagami Sea, Japan.
2. *R. decora* F. E. Sch., 1900, S.W. of Cape Comorin.
3. *R. cylindrica* n. sp., off northern extremity of Celebes.
4. *R. komeyamai* Ijima, 1901, Sagami Sea, Japan.
5. *R. delicata* H. V. Wilson, 1904, Galapagos.

6. *R. phœnix* O. Schm., 1880, Gulf of Mexico; Barbados, Santa Cruz in the Gulf of Mexico; Azores; N. Atlantic; Bay of Biscay; Sta Lucia and St. Vincent, W. Ind.; near Galapagos; coast of Chile; Nicobars, Bay of Bengal.

Genus II. **Corbitella** J. E. Gray, 1867.

Corbitella J. E. Gray, 1867, p. 530; Ijima, 1902, p. 31.

1. *C. speciosa* (Quoy and Gaim.), 1833, Mollucas.
2. *C. elegans* (Marsh.), 1887, Mollucas.
3. *C. pulchra* (F. E. Sch.), 1887, near Kandavu, (Fiji Is.).

Genus III. **Heterotella** J. E. Gray, 1867.

Heterotella J. E. Gray, 1867, p. 531; Ijima, 1902, p. 32.

1. *H. corbicula* (Bwbk), 1858, Island of Bourbon.

Genus IV. **Walteria** F. E. Sch., 1886.

Walteria F. E. Sch., 1886, p. 42; Ijima, 1901, p. 278.

1. *W. flemmingi* F. E. Sch., 1886, N. of Kermadec Is.
2. *W. leuckarti* Ijima, 1896, Sagami Sea, Japan.

Genus V. **Dictyaulus** F. E. Sch., 1895.

Dictyaulus F. E. Sch., 1895, p. 36.

1. *D. elegans* F. E. Sch., 1895, near Laccadives, Arabian Sea; S.S.W. of Comorin Cape, Indian Ocean.

Genus VI. **Dictyocalyx** F. E. Sch., 1886.

Dictyocalyx F. E. Sch., 1886, p. 43.

1. *D. gracilis* F. E. Sch., 1886, South of Tahiti, South Pacific.

Genus VII. **Hertwigia** O. Schm., 1880.

Hertwigia O. Schm., 1880, p. 62; F. E. Sch., 1904, p. 135.

1. *H. falcifera* O. Schm., 1880, near Dominica; Azores; Cape Verde Is.

Genus VIII. **Trachycaulus** F. E. Sch., 1886.

Trachycaulus F. E. Sch., 1886, p. 46; F. E. Sch., 1887, p. 373.

1. *T. gurlitti* F. E. Sch., 1886, Mid-south Pacific.

Genus IX. **Saccocalyx** F. E. Sch., 1895.

Saccocalyx F. E. Sch., 1895, p. 53.

1. *S. pedunculata* F. E. Sch., 1895, Middle of the Bay of Bengal.

Genus X. **Rhabdopectella** O. Schm., 1880.

Rhabdopectella O. Schm., 1880, p. 62; F. E. Sch., 1886, p. 43; 1887, p. 370.

1. *Rh. tintinnus* O. Schm., 1880, Grenada, N. Atlantic; Azores; Gulf of Mexico.

Genus XI. **Hyalostylus** F. E. Sch., 1886.

Hyalostylus F. E. Sch., 1886, p. 44; F. E. Sch., 1887, p. 371.

1. *Hy. dives* F. E. Sch., 1886, Mid-south Pacific.

Genus XII. **Bolosoma** Ijima.

Placosoma Ijima, 1903, p. 2; 1904, p. 305.

1. *B. paradictyum* Ijima, 1903, Sagami Sea, Japan.
2. *B. cavum* n. sp., off to S. of the western end of Timor; Ceram Sea.

Fam. III. CAULOPHACIDAE Ijima, 1903.

Caulophacidae Ijima, 1903, pp. 78—84, p. 112; F. E. Sch., 1904, p. 173; Ldfd., 1915, p. 47.

Genus I. **Caulophacus** F. E. Sch., 1886.

Caulophacus F. E. Sch., 1886, p. 46; F. E. Sch., 1887, p. 124; F. E. Sch., 1897, p. 525; F. E. Sch., 1903, p. 13; Ijima, 1903, pp. 85—87, p. 112; F. E. Sch., 1904, p. 137.

1. *C. latus* F. E. Sch., 1886, half way between Kerguelen I. and Cape of Good Hope.
2. *C. elegans* F. E. Sch., 1886, East of Japan.
3. *C. schulzei* Wilson, 1904, Gulf of Panama; off coast of Equador; off northern Peru.
4. *C. scotiae* Topsent, 1910, Antarctic Ocean.
5. *C. agassizi* F. E. Sch., 1899, S. E. of Massachusetts; N. W. Atlantic.
6. *C. arcticus* (Armauer Hansen), 1885, (= *Hyalonema arcticum* Arm. Hans., 1885), Shetland I., N. E. Atlantic.
7. *C. pipetta* (F. E. Sch.), 1886, Southern Ocean.
8. *C. instabilis* Topsent, 1910, Antarctic Ocean.
9. *C. antarcticus* F. E. Sch. and Kirkpatrick, 1910, N. W. of Gauss Station.
10. *C. oviformis* (F. E. Sch.), 1886, (= *Pleorhabdus oviformis* F. E. Sch., 1886); Antarctic Ocean.
11. * *C. lotifolium* Ijima, 1903, Sagami Sea, Japan.
12. * *C. valdiviae* F. E. Sch., 1904, near Enderby-land (Antarctic).

Genus II. **Caulophacella** Ldfd., 1915.

Caulophacella, Ldfd., 1915, p. 64.

1. *C. tenuis* Ldfd., 1915, Eastern tropical Pacific.

* The species indicated by asterisks are those which might be dealt with a distinct genus, as already noted (see p. 345).

Genus III. **Sympagella** O. Schmidt, 1870.

Sympagella, O. Schmidt, 1870, p. 15; Gray, 1872, p. 457; Carter, 1873, p. 283; Carter, 1873, p. 360; Marshall, 1875, p. 142; Marshall, 1876, p. 127; Milne-Edwards, 1881, p. 931; F. E. Sch., 1887, p. 119; Ijima, 1903, pp. 96, 113, 121.

1. *Sy. nux* O. Schm., 1870, Florida; near St. Jago I., (one of the Cape Verde Is.); N. Atlantic; off the coast of Spain and Portugal; Aegaean Sea; S. Miguel, Azores.
2. *Sy. anomala* Ijima, 1903, Sagami Sea, Japan.
3. *Sy. johnstoni* (F. E. Sch.), 1886, S. Indian Ocean, between Kerguelen I. and Cape of Good Hope.
4. *Sy. gracilis* (F. E. Sch.), 1903, Timor (Sunda Is.).

Genus IV. **Calycosilva** Ldfd., 1915.

Calycosilva Ldfd., 1915, p. 67.

1. *C. cantharellus* Ldfd., 1915, northern Peru.
2. *C. canth.* var. *helix* Ldfd., 1915, ditto.
3. *C. canth.* var. *megonychia* Ldfd., 1915, ditto.
4. *C. canth.* var. *simplex* Ldfd., 1915, ditto.

Fam. IV. ROSSELLIDAE (F. E. Sch.), 1897.

Rossellidae F. E. Sch., 1897, p. 532; F. E. Sch., 1902, p. 78; Ijima, 1903, p. 114; Ijima, 1904, pp. 1—2; F. E. Sch., 1904, p. 175; F. E. Sch., 1902, p. 78; Ldfd., 1915, p. 93.

Subfam. a. LANUGINELLINAE F. E. Sch., 1897.

Lanuginellinae F. E. Sch., 1897, p. 545; Ijima, 1904, pp. 2, 3; Ldfd., 1915, p. 103.

Genus I. **Lanuginella** O. Schmidt, 1869.

Lanuginella O. Schm., 1869, pp. 89, 261; O. Schm., 1870, p. 13; S. Kent, 1870, p. 247; F. E. Sch., 1886, p. 47; F. E. Sch., 1887, p. 129.

1. *L. pupa* O. Schm., 1870, Coast of Spain and Portugal; St. Jago (Cape Verde Is.); off Little Kei I.; N.N.W. of Centa (Str. of Gibraltar); Sagami Sea, Japan.

Genus II. **Lanugonychia** Ldfd., 1915.

Lanugonychia Ldfd., 1915, p. 103.

1. *L. flabellum* Ldfd., 1915, N. E. of Easter I. (South-eastern Pacific).

Genus III. **Calycosoma** F. E. Sch., 1899.

Calycosoma F. E. Sch., 1899, pp. 27, 99; Ijima, 1903, p. 83.

1. *C. validum* F. E. Sch., 1896, S. E. of Massachusetts; Antarctic Ocean.

Genus IV. **Mellonympha** F. E. Sch., 1897.

Mellonympha F. E. Sch., 1897, p. 547.

1. *M. velata* (W. Thoms.), 1873, (= *Rossella velata* W. Th.); Atlantic, off the mouth to the Str. of Gibraltar; off the coast of Ireland; N.W. of the Shetland Is.

Genus V. **Lophocalyx** F. E. Sch., 1887.

Rossella Gray, 1872, p. 137; Gray, 1873, p. 234; Carter, 1873, p. 361; Carter, 1875, p. 118.
Polylophus F. E. Sch., 1886, p. 47.
Lophocalyx F. E. Sch., 1887, p. 132; F. E. Sch., 1897, p. 546.

1. *L. philippinensis* (Gray), 1872, Cebu, Phil. Is.; Little Kei I., Phil. Is.
2. *L. suluanus* n. sp., Southern part of Sulu Sea, near Pearl Bank, near Kei Is.
3. *L. spinosa* F. E. Sch., 1900, W. of Andamans.

Subfam. b. ROSSELLINAE F. E. Sch., 1897.

Rossellinae, F. E. Sch., 1897, p. 532; Ijima, 1904, pp. 16, 18; Ldfd., 1915, p. 93.

Genus I. **Rossella** Carter, 1872.

Rossella Carter, 1872, p. 409; Bowerbank, 1872, pp. 58—61; Gray, 1872, p. 134; Carter, 1873, p. 275; Gray, 1873, p. 234; Carter, 1873, p. 361; Gray, 1874, p. 284; Carter, 1875, p. 113; W. Suhm, 1875, p. 25; Marshall, 1876, p. 113; Marshall & Meyer, 1877, p. 261; F. E. Sch., 1886, p. 47; F. E. Sch., 1887, pp. 136—139, 374; F. E. Sch., 1897, p. 536; Ijima, 1898, p. 51; Ijima, 1904, p. 21; F. E. Sch. & Kirkpatrick, 1910, p. 13.

1. *R. dubia* (F. E. Sch.), 1897, (= *Acanthascus dubius* F. E. Sch., 1886), S. of Puerta Bueno (Patagonia); Magellan Strait.
2. *R. fibulata* F. E. Sch. & Kirkpatrick, 1910, from Gauss Station.
3. *R. antarctica* Carter, 1872, Antarctic.
4. *R. antarctica antarctica* Carter, 1872, Antarctic.
5. *R. antarctica gaussi* F. E. Sch. & Kirkpatrick, 1910, from Gauss Station.
6. *R. antarctica solida* Kirkpatrick, 1907 (= *Acanthascus grossularia* F. E. Sch., 1886), S. E. of Prince Edward I.; S. of the Kerguelen Is.; Christmas Harbour, Kerguelen; E. of Buenos Ayres (S. Atlantic); N. Possession I.
7. *R. gaussi* F. F. Sch. & Kirkpatrick, 1910, (= *R. racovitzae* F. E. Sch. & Kirkpatrick, 1910), from Gauss Station.
8. *R. lychnophora* F. E. Sch. & Kirkpatrick, 1910, from Gauss Station.

. . *nodastrella* Topsent, 1915, near San Miguel Azores.
10. *R. mixta* F. E. Sch. & Kirkpatrick, 1910, from Gauss Station.
11. *R. podagrosa* Kirkp., 1907, Circumpolar region, Antarctic.
12. *R. racovitzae* Topsent, 1901, Antarctic.
13. *R. racovitzae racovitzae* 1908, Region of Alexander I. Land.
14. *R. racovitzae minuta* F. E. Sch. & Kirkp., 1910, from Gauss Station.
15. *R. racovitzae hexactinophila* Kirkp., 1910, Antarctic.
16. *R. racovitzae microdiscina* Topsent, 1916, near Alexander I. Land.

Genus II. **Aulorossella** Kirkp., 1907.

Aulorossella Kirkp., 1907, pp. 14, 15; F. E. Sch. & Kirkp., 1910, p. 300; F. E. Sch. & Kirkp., 1910, pp. 31, 32.
1. *A. vanhoeffeni* F. E. Sch. & Kirkp., 1910, from Gauss Station.
2. *A. vanhoeffeni armata* F. E. Sch. & Kirkp., 1910, from Gauss Station.
3. *A. laevis* Kirkp., 1907, Winter Quarters & McMurdo Bay.
4. *A. gaini* Topsent, 1916, near Adelaide Land.
5. *A. pilosa* Kirkp., 1907, off Coulman I., Antarctic Ocean; off Adelaide Land.
6. *A. aperta* Topsent, 1916, off to W. of Alexander I. Land.
7. *A. longstaffi* Kirkp., 1907, Winter Quarters, Antarctic Sea.

Genus III. **Gymnorossella** Topsent, 1916.

Gymnorossella Topsent, 1916, p. 164; Topsent, 1917, p. 22.
1. *Gy. inermis* Topsent, 1916, near Alexander I. Land.
2. *Gy. nuda* (Topsent), 1901, Antarctic.

Genus IV. **Scyphidium** F. E. Sch., 1900.

Scyphidium F. E. Sch., 1900, p. 104; Ijima, 1904, pp. 20, 21.
1. *Scy. septentrionale* F. E. Sch., 1900, N. of Spitzbergen.
2. *Scy. longispina* (Ijima), 1896, Sagami Sea, Japan.
3. *Scy. namiyei* (Ijima), 1898, Sagami Sea, Japan.
4. *Scy. chilense* Ijima, 1904, (= *Rossella* sp., F. E. Sch., 1899), Messier Canal in Chile.

Genus V. **Vitrollula** Ijima, 1898.

Vitrollula Ijima, 1898, p. 47; Ijima, 1904, p. 37.
1. *V. fertilis* Ijima, 1898, Sagami Sea, Japan.

Genus VI. **Schaudinnia** F. E. Sch., 1900.

Schaudinnia F. E. Sch., 1900, p. 87.
1. *Sch. arctica* F. E. Sch., 1900, N. of Spitzbergen.

Genus VII. **Crateromorpha** J. E. Gray, 1872.

Crateromorpha J. E. Gray, 1872, p. 136; Carter, 1872, p. 110; Carter, 1873, p. 275; Carter, 1873, p. 349; Gray, 1874, p. 284; Carter, 1875, p. 1; Marshall, 1875, p. 142; Marshall, 1876, p. 113; Zittel, 1877, p. 1; F. E. Sch., 1886, p. 52; F. E. Sch., 1887, p. 161; F. E. Sch., 1897, p. 539; Ijima, 1898, p. 48; Ijima, 1904, pp. 55, 56.
1. *C. tumida* F. E. Sch., 1886, near Banda I.
2. *C. meyeri* Gray, 1872, Cebu, Phil. Is.; Sagami Sea, Japan.
3. *C. pachyactina* Ijima, 1898, Tosa Sea, Japan.
4. *C. thierfelderi* F. E. Sch., 1886, (= *C. murrayi* F. E. Sch., 1886), near Little Kei I.
5. *C. meyeri* var. *tuberosa* Ijima, 1898, Sagami Sea, Suruga Bay, Japan.
6. *C. meyeri* var. *rugosa* Ijima, 1898, Sagami Sea, Japan.
7. *C. corrugata* Ijima, 1898, Sagami Sea, Japan.

Genus VIII. **Hyalascus** Ijima, 1896.

Hyalascus Ijima, 1896, p. 251; Ijima, 1898, p. 50; Ijima, 1903, p. 82; Ijima, 1904, p. 87.
1. *Hy. giganteus* Ijima, 1898, Sagami Sea, Japan.
2. *Hy. hodgsoni* Kirkp., 1907, off Mount Erebus, Antarctic Ocean.
3. *Hy. similis* Ijima, 1904, off coast of Tōtōmi, Japan.
4. *Hy. sagamiensis* Ijima, 1896, Sagami Sea, Japan.

Genus IX. **Anaulosoma** Kirkp., 1907.

Anaulosoma Kirkp., 1907, p. 20.
1. *A. schulzei* Kirkp., 1907, Winter Quarters, Antarctic.

Genus X. **Aulochone** F. E. Sch., 1886.

Aulochone F. E. Sch., 1886, p. 54; F. E. Sch., 1887, p. 168; F. E. Sch., 1897, p. 539; Ijima, 1904, p. 56.
1. *A. cylindrica* F. E. Sch., 1886, (= *Crateromorpha cylindrica* F. E. Sch., 1897), N. E. of the Kermadec Is.
2. *A. lilium* F. E. Sch., 1886, (= *Crateromorpha lilium* F. E. Sch., 1897), near the Meangis Is. (N. E. of Celebes).
3. *A. lankesteri* (Kirkp.), 1902, (= *Aulochone lankesteri* Kirkp., 1902), off east London, (South Africa).

Genus XI. **Aulosaccus** Ijima, 1896.

Aulosaccus Ijima, 1896, p. 252; F. E. Sch., 1897, p. 543; Ijima, 1898, p. 51; Ijima, 1904, pp. 107—109.

1. *A. ijimae* (F. E. Sch.), 1899, near Trinity Is. (N. Pacific; South Alaska).
2. *A. schulzei* Ijima, 1896, Sagami Sea, Japan.
3. *A. mitsukurii* Ijima, 1898, Sagami Sea, Japan.

Genus XII. **Asconema** S. Kent, 1870.

Asconema S. Kent, 1870, p. 241; G. Jeffreys, 1871, p. 258; Gray, 1872, p. 442; Thomson, 1873, p. 429; Carter 1874, p. 349; Gray, 1874, p. 284; Marshall, 1875, p. 142; Marshall, 1876, p. 113; Normann, 1880, p. 430; O. Schmidt, 1880, p. 65; Milne-Edwards, 1881, p. 876; Filhol, 1885, p. 288; F. E. Sch., 1887, p. 113.

1. *A. setubalense* S. Kent, 1870, Bay of Biscay; off Marocco coast; Faroë I., Azores; near New Foundland, W. Indies; N. Atlantic; off Portuguese coast; off Nova Scotia and New England; Spain.

Genus XIII. **Trichasterina** F. E. Sch., 1900.

Trichasterina F. E. Sch., 1900, p. 100.

1. *T. borealis* F. E. Sch., 1900, N. of Spitzbergen.
2. *T. sagittaria* Topsent, 1913, near Lofoten I. (Atlantic Ocean).

Genus XIV. **Aphorme** F. E. Sch., 1899.

Aphorme F. E. Sch., 1899, pp. 40, 102.

1. *A. horrida* F. E. Sch., 1899, near San Diego (Calif.).

Genus XV. **Bathydorus** F. E. Sch., 1886.

Bathydorus F. E. Sch., 1886, p. 49; F. E. Sch., 1887, p. 150; F. E. Sch., 1895, pp. 61—62; F. E. Sch., 1897, p. 533; F. E. Sch., 1902, p. 78; Ldfd., 1915, p. 94.

1. *B. fimbriatus* F. E. Sch., 1886, Middle of North Pacific.
2. *B. stellatus* F. E. Sch., 1886, Messier Channel, off Patagonia; Port Grappler; Magellan Strait.
3. *B. spinosus* F. E. Sch., 1886, Penguin I.; Antarctic Ocean; West of Crozet I.
4. *B. baculifer* F. E. Sch., 1886, Middle of South Pacific.
5. *B. uncifer* F. E. Sch., 1899, near Galapagos.
6. *B. pedunculatus* n. sp., off north end of Celebes.
7. *B. laevis* F. E. Sch., 1895, S. W. part of Bay of Bengal.
8. *B. laevis spinosus* H. V. Wilson, 1904, Gulf of Panama; off coast of Equador.
9. *B. laevis* var. *ciliatus* Topsent, 1910, Antarctic.
10. *B. spinosissimus* Ldfd., 1915, off northern Peru.

Genus XVI. **Anoxycalyx** Krkp., 1907.

Anoxycalyx Krkp., 1907, p. 23; F. E. Sch. and Krkp., 1910, p. 302.

1. *A. ijimai* Krkp., 1907, Winter Quarters.

Genus XVII. **Scolymastra** Topsent, 1916.

Scolymastra Topsent, 1916, p. 163; Topsent, 1917, p. 26.

1. *S. joubini* Topsent, 1916, N. of Graham Land.

Subfam. C. ACANTHASCINAE Ijima, 1904.

Acanthascinae Ijima, 1904, pp. 127—139; F. E. Sch. and Krkp., 1910, pp. 43, 44; Ldfd., 1915, p. 112.

Genus I. **Acanthascus** F. E. Sch., 1886.

Acanthascus F. E. Sch., 1886, p. 48; F. E. Sch., 1887, p. 145; F. E. Sch., 1897, p. 551; Ijima, 1904, p. 139.

1. *A. cactus* F. E. Sch., 1886, Enoshima, Sagami Sea, Japan.
2. *A. platei* F. E. Sch., 1899, W. of San Diego, Calif.
3. *A. alani* Ijima, 1898, Sagami Sea, Japan.

Genus II. **Staurocalyptus** Ijima, 1897.

Staurocalyptus Ijima, 1897, p. 53; Ijima, 1898, p. 52; F. E. Sch., 1899, p. 103) Ijima, 1914, p. 162; Ldfd., 1915, p. 112.

1. *St. glaber* Ijima, 1897, Sagami Sea, Japan.
2. *St. celebensis* n. sp., off N. end of Celebes.
3. *St. affinis* Ijima, 1904, Sagami Sea, Japan.
4. *St. dowlingi* (Lambe), 1893, Str. of Georgia; near St. Rosa Is.; near Lenard Rock (Aleutian Is.).
5. *St. roeperi* (F. E. Sch.), 1886, S. of Puerto Buona (Patagonia).
6. *St. entacanthus* Ijima, 1904, Sagami Sea, Japan.
7. *St. fasciculatus* F. E. Sch., 1899, S. of Santa Cruz I. (Calif.).
8. *St. pleorhaphides* Ijima, 1897, Sagami Sea, Japan.
9. *St. hamatus* Ldfd., 1915, Eastern tropical Pacific.
10. *St. solidus* F. E. Sch., 1899, Santa Cruz I. (Calif.); S. W. of Cape Flattery (Calif.); near Montery Calif.
11. *St. tubulosus* Ijima, 1904, Sagami Sea, Japan.
12. *St. microchetus* Ijima, 1898, Sagami Sea, Japan.
13. *St. heteractinus* Ijima, 1897, Sagami Sea, Japan.

Genus III. **Rhabdocalyptus** F. E. Sch., 1886.

Rhabdocalyptus F. E. Sch., 1886, p. 51; F. E. Sch., 1887, p. 155; Ijima, 1897, p. 49; F. E. Sch., 1897, p. 552; Ijima, 1904, p. 236; F. E. Sch., 1904, p. 140.

1. *Rh. dowsoni* (Lambe), 1892, The mouth of Qualicum R. Vancouver I.; St. of Georgia near Comox, Vancouver I.; coast of California; E. of Santa Cruz I. (California); W. of Punta Arena (Calif.).
2. *Rh. tenuis* (F. E. Sch.), 1899, S. of Cape Flattery (Calif.).
3. *Rh. asper* F. E. Sch., 1899, S. of San Diego, Calif.
4. *Rh. victor* Ijima, 1897, Sagami Sea, Japan.
5. *Rh. unguiculatus* Ijima, 1904, Sagami Sea, Japan.
6. *Rh. plumodigitatus* Krkp., 1901, (= *Ph. lophodigitatus* Krkp., 1901), N. of Lion's Head, S. Afrika.
7. *Rh. mirabilis* F. E. Sch., 1899, S. of Alaska near Chernobours Rocks.
8. *Rh. mollis* F. E. Sch., 1886, Sagami Sea, Japan.
9. *Rh. nodulosus* F. E. Sch., 1899, S. of St. Barbara (Calif.); W. of San Diego (Calif.).
10. *Rh. capillatus* Ijima, 1897, Sagami Sea, Japan.
11. *Rh. tener* F. E. Sch., 1899. S. of San Diego (Calif.).
12. *Rh. baculifer* F. E. Sch., 1904, Agulhas Bank (S. of Cape of Good Hope).
13. *Rh. australis* Topsent, 1901, Antarctic.

LIST OF LITERATURE REFERRED TO IN THIS REPORT.

BOCAGE, J. V., Barboza du, 1864. — "Note sur la découverte d'un zoophyte de la fam. Hyalochaetides sur la côte du Portugal". — Proc. Zool. Soc. Lond. 1864, pp. 265—269; pl. XXII.

BOWERBANK, J. S., 1862. — "On the anatomy and physiology of the Spongiadae, Pt. II". — Phil. Trans., CLII, 2, pp. 747—829; pls. XXVII—XXXV. — Pt. III, ibid., pp. 1087—1135; pls. LXXII—LXXIV.

—— 1864. — "A monograph of the British Spongiadae". — London.

—— 1869. — "A monograph of the siliceo-fibrous sponges, Pt. I". — Proc. Zool. Soc. Lond. 1869, pp. 66—100; pls. III—VI. — Pt. II, ibid., pp. 328—351; pls. XXI—XXV.

CARTER, H. J., 1872 (*a*). — "On two new sponges from the Antarctic Sea". — Ann. and Mag. Nat. Hist., ser. 4, vol. IX, pp. 414—417; pl. XXI.

—— 1872 (*b*). — Descriptions of two new sponges from the Philippine Islands. — Ann. and Mag. Nat. Hist., ser. 4, vol. X, pp. 110—113.

—— 1873. — "On the Hexactinellidae and Lithiotidae generally, and particularly on the Aphrocallistidae, Aulodictyon and Farreae, together with facts elicited from their deciduous structures, and descriptions respectively of three new species". — Ann. and Mag. Nat. Hist., ser. 4, vol. XII, pp. 347—373; 437—472; pls. XIII—XVII.

—— 1877. — "On two vitreo-hexactinellid sponges". — Ann. and Mag. Nat. Hist., ser. 4, vol. XIX, pp. 121—131; pl. IX.

—— 1885. — "Report on a collection of marine sponges from Japan, made by Dr. J. Anderson". — Ann. and Mag. Nat. Hist., ser. 5, vol. XV, pp. 387—400; pls. XII—XIV.

CLAUS, C., 1868. — "Über Euplectella aspergillum (R. Owen). Ein Beitrag zur Naturgesch. der Kieselschwämme". 30 pages, 3 pls.

DENDY, A., 1916. — "A report on the Hexactinellid sponges collected by H. M. S. Sealark in the Indian Ocean". — Trans. Linn. Soc. Lond., ser. 2, vol. XVII, st. 2.

GRAY, J. E., 1832. — "Synopsis of the contents of the British Museum" 27th edition.

—— 1835. — "On the coral known as the glass plant (Hyalonema Sieboldi)". — Proc. Zool. Soc. Lond., vol. III, pp. 63—65.

—— 1857. — "Synopsis of the families and genera of axiferous zoophytes or barbed corals". — Proc. Zool. Soc. Lond., vol. XXV, pp. 278—282; pl. IX.

—— 1858. — "On *Aphrocallistes*, a new genus of Spongiadae from Malacca". — Proc. Zool. Soc. Lond., vol. XXVI, p. 114; pl. XI.

—— 1859. — "Description of *MacAndrewia* and *Myliusia*, two new forms of sponges". — Proc. Zool. Soc. Lond., vol. XXVII, pp. 437—440; pls. XV and XVI.

—— 1867. — "Notes on the arrangement of sponges, with the description of some new genera". — Proc. Zool. Soc. Lond. for 1867, pp. 492—558, pls. XXVII and XXVIII.

—— 1868. — "Note on *Hyalonema schulzei*, Semper". — Ann. and Mag. Nat. Hist., ser. 4, vol. II, pp. 373—377.

—— 1870. — "Notes on anchoring sponges". — Ann. and Mag. Nat. Hist., ser. 4, vol. VI, pp. 309—312.

GRAY, J. E., 1872. — "On a new genus of hexradiate and other sponges discovered in the Philippine Islands by Dr. A. B. Meyer". — Ann. and Mag. Nat. Hist., ser. 4, vol. X, pp. 134—139.

HERKLOTS, J. A. and MARSHALL, W., 1868. — "Notice sur deux espèces nouvelles d'eponges de la famille des Lophospongiae". — Arch. néerlandaises sci. exact. et nat., vol. III, pp. 435—438.

HIGGIN, T., 1875. — "On two hexactinellid sponges from the Philippine Islands in the Liverpool Free Museum". — Ann. and Mag. Nat. Hist., ser. 4, vol. XV, pp. 357—390; 2 pls.

IJIMA, I., 1894. — "Notice of new Hexactinellida from Sagami Bay. I". — Zool. Anz., 1894, pp. 365—369.

—— 1895. — "On two new Hexactinellida from Sagami Bay". — Zool. Mag. Tokyo, vol. VII, N° 79.

—— 1896. — "Notice of new Hexactinellida from Sagami Bay. II". — Zool. Anz., 1896, pp. 249—253.

—— 1897. — "Revision of Hexactinellids with discoctasters, with descriptions of five new species". — Annot. Zool. Jap., vol. I, pp. 43—59.

—— 1898. — "The genera and species of Rossellidae". — Annot. Zool. Jap., vol. II, pp. 41—55.

—— 1901. — "Studies on the Hexactinellida. Contrib. I". — Jour. Sci. College, Imp. Univ. Tokyo, vol. XV, pp. 1—299; pls. I—XIV.

—— 1902. — Same. Contrib. II. — Ibid., vol. XVII, Art. 9, 32 pages, 1 pl.

—— 1903. — Same. Contrib. III. — Ibid., vol. XVIII, Art. 1, 124 pages, 8 pls.

—— 1916. — "Notes on *Aphrocallistes beatrix* Gray, particularly with reference to the form occurring in East Asiatic Seas". — Annot. Zool. Jap., vol. IX, pp. 173—183.

KENT, W. S., 1870. — "On the Hexactinellidae or hexradiate spiculed siliceous sponges taken in the 'Norna' expedition off the coast of Spain and Portugal. With description of new species and revision of the order". — Monthly Microsc. Jour., vol. IV, pp. 241—252; pls. LXIII—LXV.

KIRKPATRICK, R., 1889. — In Green's Report of a deep-sea trawling cruise off the S.W. coast of Ireland. — Ann. and Mag. Nat. Hist., ser. 6, vol. IV, p. 446.

—— 1907. — "Porifera Hexactinellida". — National Antarctic Expedition. Nat. Hist., vol. III, 25 pages, 7 pls.

—— 1908. — "Description of a new dictyonine sponge from the Indian Ocean". — Records of the Indian Museum, vol. II, pt. 1, N° 2.

—— 1909. — "On the phylogeny of the Amphidiscophora". — Ann. and Mag. Nat. Hist., ser. 8, vol. IV, pp. 479—484.

—— 1910 (*a*). — „On Hexactinellid sponge spicules and their names". — Ann. and Mag. Nat. Hist., ser. 8, vol. V, pp. 208—213; 1 pl.

—— 1910 (*b*). — "On Hexactinellid spicules and their names. Supplementary". — Ann. and Mag. Nat. Hist., ser. 8, vol. V, pp. 347—350.

LAMBE, L. M., 1892. — "On some sponges from the Pacific coast of Canada and Behring Sea". — Trans. Roy. Soc. Canada, sect. IV, 1892, pp. 73—75.

LEIDY, J., 1868. — "Description of a new species of sponge (*Pheronema annae*)". — Proc. Acad. Nat. Sci. Philadelphia, 1868, pp. 9—10.

LENDENFELD, R. v., 1915. — "Reports on the scientific results of the expedition to the eastern tropical Pacific, etc. XXIX. The sponges. 3. Hexactinellida". — Mem. Mus. Comp. Zool. Harvard College.

MARSHALL, W., 1875. — "Untersuchungen über Hexactinelliden". — Zeitschr. f. wiss. Zool., Bd. XXV, Suppl., pp. 142—243, pls. XI—XVII.

—— 1876. — "Ideen über der Verwandtschaftverhältnisse der Hexactinelliden". — Zeitschr. f. wiss. Zool., Bd. XXVII, pp. 113—136.

MINCHIN, E. A., 1905. — "A speculation on the phylogeny of Hexactinellid sponges". — Zool. Anz., Bd., XXVIII, pp. 439—448.

MURIE, J., 1876. — "On Steere's sponge, a new genus of the Hexactinellid group of the Spongida". — Trans. Linn. Soc. Lond., ser. 2, I, pp. 219—234, pls. XXXVI and XXXVII.

OWEN, R., 1841. — "On a new genus and species of sponge (*Euplectella aspergillum*)". — Trans. Zool. Soc. Lond., III, 2, pp. 203—206.

—— 1857. — "Description of a new species of *Euplectella* (*E. cucumer*)." — Trans. Linn. Soc. Lond., XXII, 2, pp. 117—123; pl. XXI.

RAUFF, H., 1893. — "Palaeospongiologie". — Palaeontographica, Bd. XL. 346 pages, 17 pls.

SCHMIDT, O., 1870. — "Grundzüge einer Spongienfauna des Atlantischen Gebietes". — Leipzig, 1870.

—— 1880. — "Die Spongien des Meerbusen von Mexiko (und des Caraibischen Meeres"). — Jena, 1880.

SCHRAMMEN, A., 1902. — "Neue Hexactinelliden aus der oberen Kreide". — Mitteil. Roemer Mus., Hildesheim, Nr. 15, 1902.

—— 1903. — "Zur Systematik der Kieselspongien". — Mitteil. Roemer Mus., Hildesheim, Nr. 19, 1903.

—— 1910—1912. — "Die Kieselspongien der oberen Kreide von Nordwest-Deutschland". — Palaeontographica, Supplement, Bd. V.

SCHULZE, F. E., 1886. — "Über den Bau und das System der Hexactinelliden". — Abh. kgl. preuss. Akad. Wiss. Berlin, 1886.

—— 1887. — "Hexactinellida". — Chall. Report, vol. XXI.

—— 1893. — "Revision des Systems der Hyalonematiden". — Sitzs.-ber. kgl. preuss. Akad. Wiss. Berlin, 1893, pp. 541—589.

—— 1895. — "Hexactinelliden des Indischen Oceanes. Ith. Die Hyalonematiden". — Abh. kgl. preuss. Akad. Wiss. Berlin, 1894.

—— 1896. — Ditto, IIth. "Die Hexasterophora". — Ibid., 1895.

—— 1897. — "Revision des Systems des Asconematiden und Rosselliden". — Sitzs.-ber. kgl. preuss. Akad. Wiss. Berlin, XXVI, pp. 520—558.

—— 1899 (*a*). — "Amerikanische Hexactinelliden nach dem Materiale der Albatross-Expedition". — Jena, 1899.

—— 1899 (*b*). — "Über *Hyalonema affine* W. Marshall". — Sitzs.-ber. Ges. naturf. Freunde, Berlin. Jahrg. 1899. pp. 112—129.

—— 1900 (*a*). — "Hexactinelliden des Indischen Oceanes". IIIth. — Abh. kgl. preuss. Akad. Wiss. Berlin, 1900.

—— 1900 (*b*). — "Mittelmeer-Hexactinelliden". — Ber. Commission f. Erforsch. d. östl. Mittelmeeres, XXIII. Zool. Ergebnisse XII, 8 pages, 1 pl.

—— 1900 (*c*). — "Die Hexactinelliden". — Fauna Arctica (Ergebn. d. deutschen Expedition in d. nördl. Eismeer in Jahre 1898), Bd. I, pp. 87—108; pls. I—IV.

—— 1900 (*d*). — "Hexactinelliden des Rothen Meeres". — Ber. d. Commission f. oceanographischen Forschungen. Zool. Ergeb. XVI. In: Denkschr. d. math.-naturwiss. Cl. d. kaiserl. Akad. Wiss. Wien, Bd. LXIX.

—— 1902. — "An account of the Indian Triaxonia collected by Royal Indian Marine Survey ship 'Investigator'." — Transl. by R. v. Lendenfeld.

—— 1903. — "*Caulophacus arcticus* (A. Hansen) und *Calycosoma gracile* F. E. Sch. nov. sp.". — Abh. kgl. preuss. Akad. Wiss. 1903, 22 pages, 2 plates.

—— 1904. — "Hexactinellida." — Wiss. Ergebn. d. deutsch. Tiefsee Exped. auf d. Dampfer "Valdivia" 1898—1899.

——, and KIRKPATRICK, R., 1910. — "Die Hexactinelliden der deutschen Südpolar Expedition 1901—1903".

SEMPER, C., 1868. — "Einige neue Kieselschwämme der Philippinen". — Verhandl. Phys-med. Gesell. Würzburg, I, pp. XXIX—XXX.

SOLLAS, W. J., 1877. — "On *Stauronema*, a new genus of fossil Hexactinellid sponges", etc. — Ann. & Mag. Nat. Hist., ser. 4, vol. XIX, pp. 1—25; 5 pls.

—— 1879. — "Observations on *Dactylocalyx pumiceus*, with a description of a new variety, *D. stutchburyi*". — Jour. Roy. Micr. Soc., vol. II, pp. 122—133; pls. V—VIII.

STEVENS, JANE, 1915. — "Sponges of the coasts of Ireland. I. The Triaxonia and part of the Tetraxonida". — Sci. Investig., Departm. of Agric. and Techn. Instruction for Ireland. Fisheries Branch, 1914, N°. IV.

STUTCHBURY, S., 1841. — "Description of a new sponge from Barbadoes. *Dactylocalyx pumiceus*". — Proc. Zool. Soc. Lond. 1841, vol. IX, p. 86—87.

THOMSON, C. E., 1868. — "On the 'vitreous' sponges". — Ann. & Mag. Nat. Hist., ser. 4, vol. I, pp. 114—132; pl. IV.

—— 1870. — "On *Holtenia*, a genus of vitreous sponges". — Phil. Trans., vol. CLIX, pp. 701—702; pls. LXVII—LXXI.

—— 1877. — "Voyage of the Challenger. The Atlantic". — Vol. I.

TOPSENT, E., 1890. — "Notice préliminaire sur les spongiaires récueillis durant les campagnes de l'Hirondelle". — Bull. Soc. Zool. France, vol. XV, pp. 70—71.

—— 1892. — "Contribution à l'étude des spongiaires de l'Atlantique Nord". — Rés. camp. sci. par Albert I, fasc. II, pp. 24—35.

—— 1895. — "Campagne du Yacht 'Princess Alice'. Notice sur les spongiaires récueillis en 1894 et 1895". — Bull. Soc. Zool. France, vol. XX, pp. 213—215.

—— 1896. — "Résultats scientifiques de la compagne du 'Caudan' dans le Golfe de Gascogne. Eponges". — Ann. de l'Univ. de Lyon, vol. II.

—— 1901 (*a*). — "Résultats du voyage du S. Y. 'Belgica' en 1897—1899. Expédition Antarctique Belg.". — Anvers 1901.

—— 1901 (*b*). — "Éponges nouvelles des Açores". — Mém. Soc. Zool. France, vol. XIV, pp. 448—466.

—— 1904 (*a*). — "Sarostegia oculata, Hexactinellide nouvelle des îles du Cap-Vert". — Bull. Mus. Oceanogr. Monaco, 1904, N°. 10.

—— 1904 (*b*). — "Spongiaires des Açores". — Rés. Camp. Sci. Prince Albert I, vol. XXV.

—— 1904 (*c*). — "Notes sur les éponges du 'Travailleur' et du 'Talisman' I". — Bull. Mus. Hist. Nat. Paris, 1904, pp. 62—66.

—— 1904 (*d*). — "Notes sur les éponges du 'Travailleur' et du 'Talisman' II". — Bull. Mus. Hist. Nat. Paris, 1904, pp. 195—200.

—— 1904 (*e*). — "Notes sur les éponges du 'Travailleur' et du 'Talisman' III". — Bull. Mus. Hist. Nat. Paris, 1904, pp. 372—377.

—— 1906. — "*Farrea occa* (Bwbk.) var. *foliascens* n. var.". — Bull. Mus. Oceanogr. Monaco, 1906, N°. 83.

—— 1910. — "Les Hexasterophora récueillies par la "Scotia" dans l'Antarctique". — Bull. de l'Inst. oceanographique, N°. 166.

—— 1913. — "Spongiaires de l'expédition Antarctique nationale Ecossaise". — Trans. Roy. Soc. Edinburgh, vol. XLIX, pt. III (N°. 9), pp. 579—643; 6 pls.

—— 1916. — "Diagnoses d'éponges récuillies dans l'Atlantique par le 'Pourquois-Pas' ". — Bull. Mus. Hist. Nat. Paris, 1916, N°. 3, pp. 163—166.

WELTNER, W., 1882. — "Beiträge zur Kenntniss der Spongien". — Inaug. Dissertation.

WILSON, H. V., 1902. — "Sponges collected in Porto Rico in 1899". — U. S. Fish Comm. Bull., 1900, vol. II, pp. 382—383.

—— 1904. — "The Sponges". — Mem. Mus. Comp. Zool. Harvard Coll., vol. XXX, N°. 1.

WRIGHT, P., 1870. — "Notes on sponges". — Quart, Jour. Micr. Sci., n. ser., vol. X, pp. 4—7; pls. I and III.

ZITTEL, K. A., 1877. — "Studien über fossile Spongien. I. Hexactinellida". — Abh. II Cl. Baier. Akad., Bd. XIII, Abh. I, pp. 1—63.

VI. ALPHABETICAL INDEX TO SCIENTIFIC NAMES GIVEN IN THIS REPORT.

	Page
ACANTHASCINAE F. E. Sch.	355
AMPHIDISCOPHORA F. E. Sch.	4
Anomochone n. g.	268
A. expansa n. sp.	269
A. globosa n. sp.	272
Aphrocallistes J. E. Gray	286
Aph. beatrix J. E. Gray	286
APHROCALLISTIDAE J. E. Gray	284
AULOCALYCIDAE n. fam.	274
AULOCYSTIDAE F. E. Sch.	301
Aulocystis F. E. Sch.	302
A. zitteli sibogae n. subsp.	305
A. zitteli zitteli (Marsh. & Mey.)	304
Bathydorus F. E. Sch.	353
B. pedunculatus n. sp.	353
Bolosoma F. E. Sch.	340
B. cavum n. sp.	340
CAULOPHACIDAE Ijima	346
Caulophacus F. E. Sch.	346
Chalaronema n. g.	43
Ch. sibogae n. sp.	43
Chaunoplectella Ijima	323
Ch. stelleta n. sp.	323
CLAVULARIA F. E. Sch	129
CORBITELLINAE Ijima	335
CRATICULARIDAE n. fam.	297
Diapleura n. g.	314
D. maasi n. sp.	314
DIAPLEURIDAE n. fam.	314
Euplectella Owen	327
E. timorensis n. sp.	327
EUPLECTELLIDAE (Gray)	326
EUPLECTELLINAE Ijima	326
Eurete Semper	166
E. freelandi n. sp.	176
E. marshalli F. E. Sch.	167
E. schmidti kampeni n. subsp.	173
E. schmidti treubi n. subsp.	170
E. trachydocus n. sp.	168
EURETIDAE F. E. Sch.	163
Farrea Bwbk.	130
F. hanitschi n. sp.	151
F. lendenfeldi n. sp.	159
F. nodulosa n. sp.	154
F. occa clavigera F. E. Sch.	137
F. occa cuspidata n. subsp.	145
F. occa erecta n. subsp.	132
F. occa mammillata n. subsp.	142
F. occa ouwensi n. subsp.	148
F. occa subclavigera n. subsp.	140
F. spirifera n. sp.	156
FARREIDAE F. E. Sch.	129
Hexactinella Carter	231
H. lata (F. E. Sch.)	225
H. lingua n. sp.	242
H. rugosa n. sp.	237
H.? spongiosa n. sp.	246
H. vermiculosa n. sp.	239
HEXACTINOSA Schram.	113
HEXASTEROPHORA F. E. Sch.	105
Hyalonema J. E. Gray	49
H. (Corynonema) rotundum n. sp.	102
H. (Coscinonema) kirkpatricki n. sp.	68
H. (Cyliconema) apertum maehrenthali F. E. Sch.	72
H. (Cyliconema) keiense n. sp.	90
H. (Cyliconema) timorense n. sp.	88
H. (Euhyalonema) intermedium n. sp.	55
H. (Euhyalonema) keianum n. sp.	58
H. (Leptonema) flagelliferum n. sp.	97
H. (Paradisconema) vosmaeri n. sp.	93
H. (Pteronema) topsenti n. sp.	61

	Page
H. (Thamnonema) thamnophorum n. sp.	99
HYALONEMATIDAE J. E. Gray	41
LANUGINELLINAE F. E. Sch.	347
Lefroyella W. Thoms.	210
L. ceramensis n. sp.	210
LEUCOPSACADIDAE Ijima	320
Leucopsacas Ijima	320
L. scoliodocus Ijima	321
Lophocalyx F. E. Sch.	347
L. suluanus n. sp.	348
LYCHNISCOSA Schram.	299
LYSSACINOSA n. tr.	319
MONORHAPHIDIDAE n. fam.	36
Monorhaphis F. E. Sch.	37
M. chuni F. E. Sch.	37
Myliusia J. E. Gray	213
M. callocyathus J. E. Gray	215
M. verrucosa n. sp.	217
Pararete n. g.	178
P. baliense n. sp.	187
P. farreopsis farreopsis (Carter)	178
P. farreopsis fragiferum n. subsp.	182
P. farreopsis jakosalemi n. subsp.	185
P. farreopsis subglobosum n. subsp.	183
P. freeri n. sp.	190
P. kangeanganum n. sp.	189
P. semperi (F. E. Sch.)	193
Periphragella Marsh.	203
P. irregularis n. sp.	208
P. parva n. sp.	205
Pheronema Leidy	9
Ph. echinatum n. sp.	21
Ph. giganteum F. E. Sch.	10
Ph. weberi n. sp.	17
PHERONEMATIDAE J. E. Gray	7
Pleurochorium Schram.	195
P. cornutum n. sp.	197
Psilocalyx n. g.	265
Ps. wilsoni n. sp.	265
Regadrella O. Schm.	335
R. cylindrica n. sp.	335
Rhabdodictyum O. Schm.	276
R. kurense n. sp.	277
ROSSELLIDAE (F. E. Sch.)	347
ROSSELLINAE F. E. Sch.	353
Sclerothamnopsis H. V. Wilson	248
Sc. schulzei n. sp.	249
Sclerothamnus Marsh.	253
Sc. clausi Marsh.	253
SCOPULARIA F. E. Sch.	163
Semperella J. E. Gray	28
S. similis n. sp.	28
Sericolophus Ijima	25
S. reflexus (Ijima)	26
Staurocalyptus Ijima	355
St. celebesianus n. sp.	355
TRETODICTYIDAE F. E. Sch.	218
Tretodictyum F. E. Sch.	220
T. pumicosum n. sp.	229
T. schrammeni, n. sp.	224
T. tubulosum F. E. Sch.	221
Tretopleura n. g.	280
T. candelabrum n. sp.	281
Tretorete n. g.	298
T. incertum n. sp.	298

EXPLANATION OF THE PLATES.

PLATE I.

Figs. 1, 2. *Hyalonema (Euhyalonema) intermedium* n. sp.

Fig. 1. The type specimen, from Stat. 262. Seen from above. About $^3/_4$ natural size.
Fig. 2. The same specimen in side view. About $^3/_4$ natural size.

Figs. 3, 4. *Hyalonema (Euhyalonema) keianum* n. sp.

Fig. 3. The type specimen, from Stat. 254. Seen from above. About $^3/_4$ natural size.
Fig. 4. The same specimen in side view. About $^3/_4$ natural size.

Figs. 5, 6. *Hyalonema (Pteronema) topsenti* n. sp.

Fig. 5. An incomplete specimen from Stat. 254, referred to the above species with doubt. Seen from above. About natural size.
Fig. 6. The same specimen in side view. About natural size.

HELIOTYPIE, J. VAN LEER & Co. AMSTERDAM.

PLATE II.

Figs. 1—10. *Chalaronema sibogæ* n. gen., n. sp.

Fig. 1. The type specimen, from Stat. 251. About $^5/_6$ natural size.
Fig. 2. The same specimen seen from above, showing the gastral sieve-plate. About $^5/_6$ natural size.
Fig. 3. A dermal pinule. × 150.
Fig. 4. A pinule from the oscular sieve-plate. × 150.
Fig. 5. Two pentactins from canalar surface. One of them with the free ray somewhat pinularly developed. × 150.
Fig. 6. A macramphidisc. × 150.
Fig. 7. A slim-rayed, intermediary microstauractin. × 150.
Fig. 8. Inferior end of a basal fiber. × 50.
Fig. 9. A small portion, higher up, of the same fiber, showing interruptedly spiral, denticulate ridges. × 50.
Fig. 10. A large part of an ambuncinate. The spicular center indicated by a whorl of largest bent spines near the lower end of the figure. × 150.

Fig. 11. *Hyalonema (Pteronema) topsenti* n. sp.

Fig. 11. A dermal pinule from the specimen shown in Pl. I, figs. 5 and 6. × 300.

Figs. 12, 13. *Hyalonema (Coscinonema) kirkpatricki* n. sp.

Fig. 12. The type specimen (A), from Stat. 271. Natural size.
Fig. 13. The second specimen (B), from the same station. Natural size.

Fig. 14. *Hyalonema (Leptonema) flagelliferum* n. sp.

Fig. 14. The type specimen, from Stat. 221. Natural size.

Fig. 15. *Hyalonema (Cyliconema) apertum maehrenthali* F. E. Sch.

Fig. 15. Specimen J, from Stat. 208. Natural size.

Fig. 16. *Hyalonema (Cyliconema) timorense* n. sp.

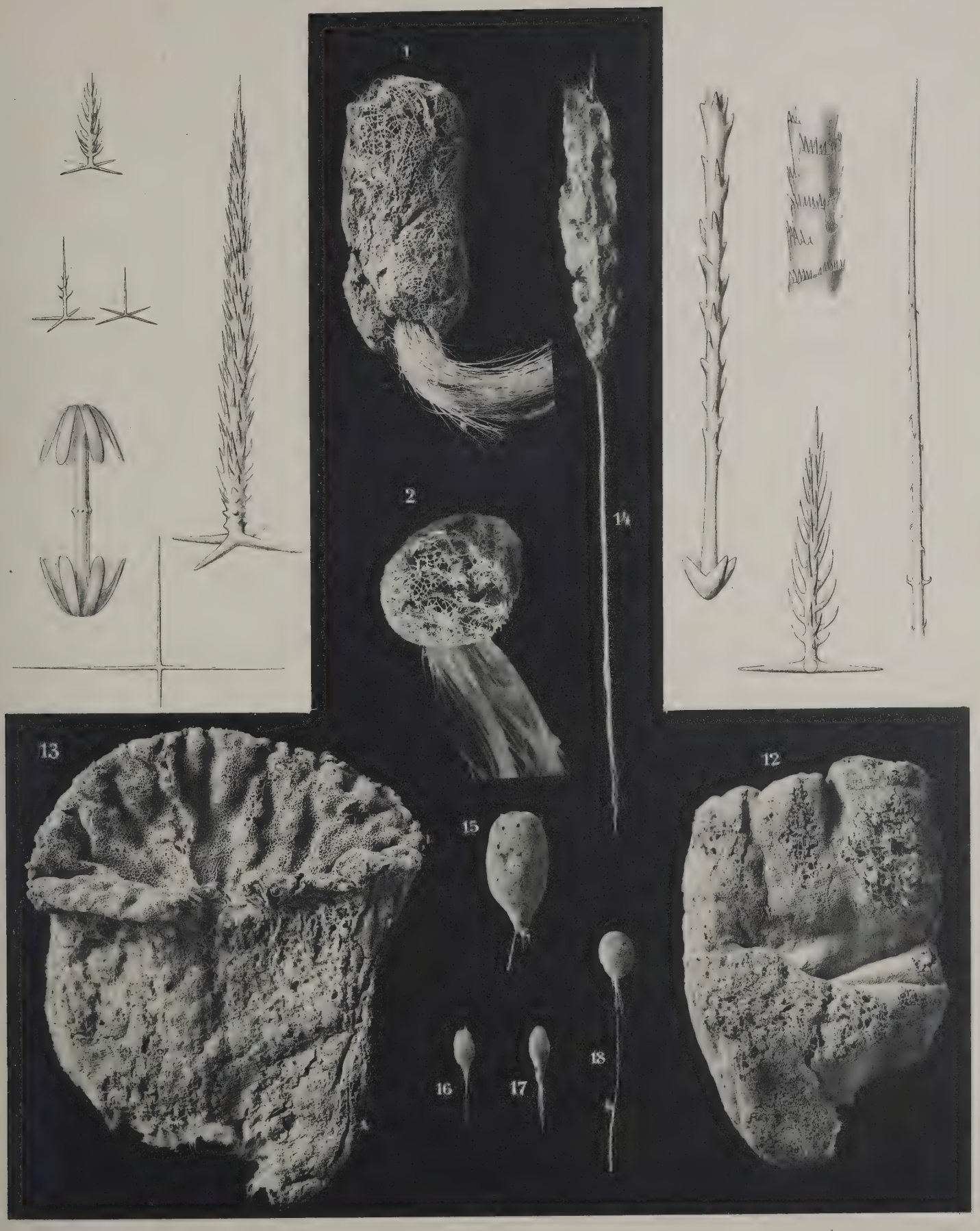
Fig. 16. The type specimen, from Stat. 284. Natural size.

Fig. 17. *Hyalonema (Thamnonema) thamnophorum* n. sp.

Fig. 17. The larger of the two specimens obtained at Stat. 221. Natural size.

Fig. 18. *Hyalonema (Corynonema) rotundum* n. sp.

Fig. 18. The type specimen, from Stat. 210a. Natural size.



HELIOTYPIE, L. VAN LEER & Cº AMSTERDAM

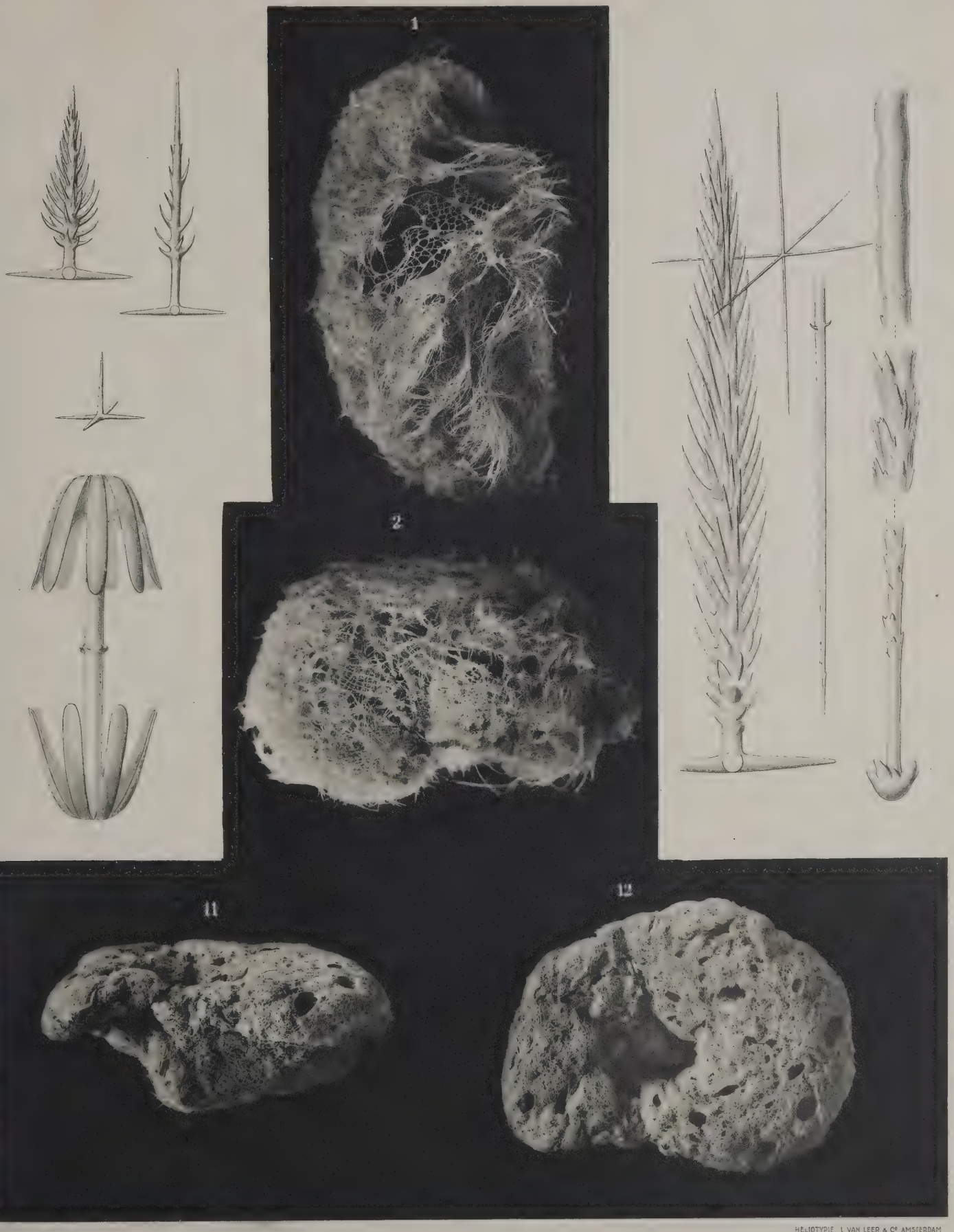
PLATE III.

Figs. 1—10. *Hyalonema (Pteronema) topsenti* n. sp.

Fig. 1. The type specimen, from Stat. 145. Seen from above, showing a remnant of the sieve-plate. Natural size.
Fig. 2. The same specimen looked at from below, showing the dermal latticework in small patches near the basal body end. Natural size.
Fig. 3. A dermal pinule. × 300.
Fig. 4. A canalar pinule. × 300.
Fig. 5. A canalar pentactin with simple free ray. × 300.
Fig. 6. A macramphidisc. × 150.
Fig. 7. A pinule of the sieve-plate. × 300.
Fig. 8. An intermediary microxyhexactin. × 300.
Fig. 9. An ambuncinate. Spicular center at the position of the bent spines near the upper end of the figure. × 75.
Fig. 10. Parts of a basal anchoring fiber taken from the columella of a second specimen (B) of the species from the same station. × 50.

Figs. 11, 12. *Hyalonema (Paradisconema) vosmaeri* n. sp.

Fig. 11. The type specimen seen from a side. From Stat. 256. $^3/_4$ natural size.
Fig. 12. The same specimen seen from above, showing the gastral cavity and surface. $^3/_4$ natural size.



HELIOTYPIE, L VAN LEER & Cº AMSTERDAM

PLATE IV.

All figures in natural size.

Figs. 1—8. *Hyalonema (Cyliconema) apertum maehrenthali* F. E. Sch.

Fig. 1. Specimen A, from Stat. 316. Seen from above.
Fig. 2. The same specimen in lateral view.
Fig. 3. Specimen B, from Stat. 314. Seen from above.
Fig. 4. The same specimen in lateral view.
Fig. 5. Specimen C, from Stat. 52.
Fig. 6. Specimen D, from Stat. 254.
Fig. 7. Specimen F, from Stat. 173.
Fig. 8. Specimen I, from Stat. 137.

Fig. 9. *Pheronema echinatum* n. sp.

Fig. 9. The type specimen, from Stat. 251.

Fig. 10—12. *Pheronema weberi* n. sp.

Fig. 10. The type specimen, from Stat. 253.
Fig. 11. Another specimen from the same station. The wall incomplete on one side.
Fig. 12. Still another specimen from the same station; small but nearly complete.

HELIOTYPIE E. J. VAN LEER & Cie AMSTERDAM

PLATE V.

Figs. 1—7. *Pheronema giganteum* F. E. Sch.

Fig. 1. The specimen from Stat. 251. $^1/_2$ natural size.
Fig. 2. A dermal pinule. × 150.
Fig. 3. A gastral pinule. × 150.
Fig. 4. Another gastral pinule with bent pinular ray. × 150.
Fig. 5. A macramphidisc. × 150.
Fig. 6. Inferior end of a basal anchoring fiber. × 50.
Fig. 7. Choanosomal intermedial oxyhexactins with tubercled or spiny rays (*a*, *b*, *c*), grading over into pentactine canalar pinules (*g*), *e*. *f*. intermediate forms. × 150.

Figs. 8—13. *Pheronema echinatum* n. sp.

Fig. 8. A dermal pinule. × 300.
Fig. 9. A gastral pinule. × 300.
Fig. 10. A macramphidisc. × 150.
Fig. 11. A micramphidisc of an average size. × 300.
Fig. 12. The outer end of a scepter. × 50.
Fig. 13. *a*, The inferior end of a fully grown basalia. *b*, A very small basalia at an early stage of development. × 50.

Figs. 14—21. *Pheronema weberi* n. sp.

Figs. 14, 15. Two dermal pinules. × 300. From the type specimen shown in pl. IV, fig. 10, which fact holds good also for figs. 16—21.
Fig. 16. A gastral pinule. × 300.
Fig. 17. A macramphidisc. × 150.
Fig. 18. Inferior end of a basal anchoring fiber. × 100.
Fig. 19. A small portion of a macruncinate. × 440.
Fig. 20. A choanosomal uncinate. × 150.
Fig. 21. A small portion of a choanosomal uncinate. × 440.

HELIOTYPIE L. VAN LEER & Cº AMSTERDAM

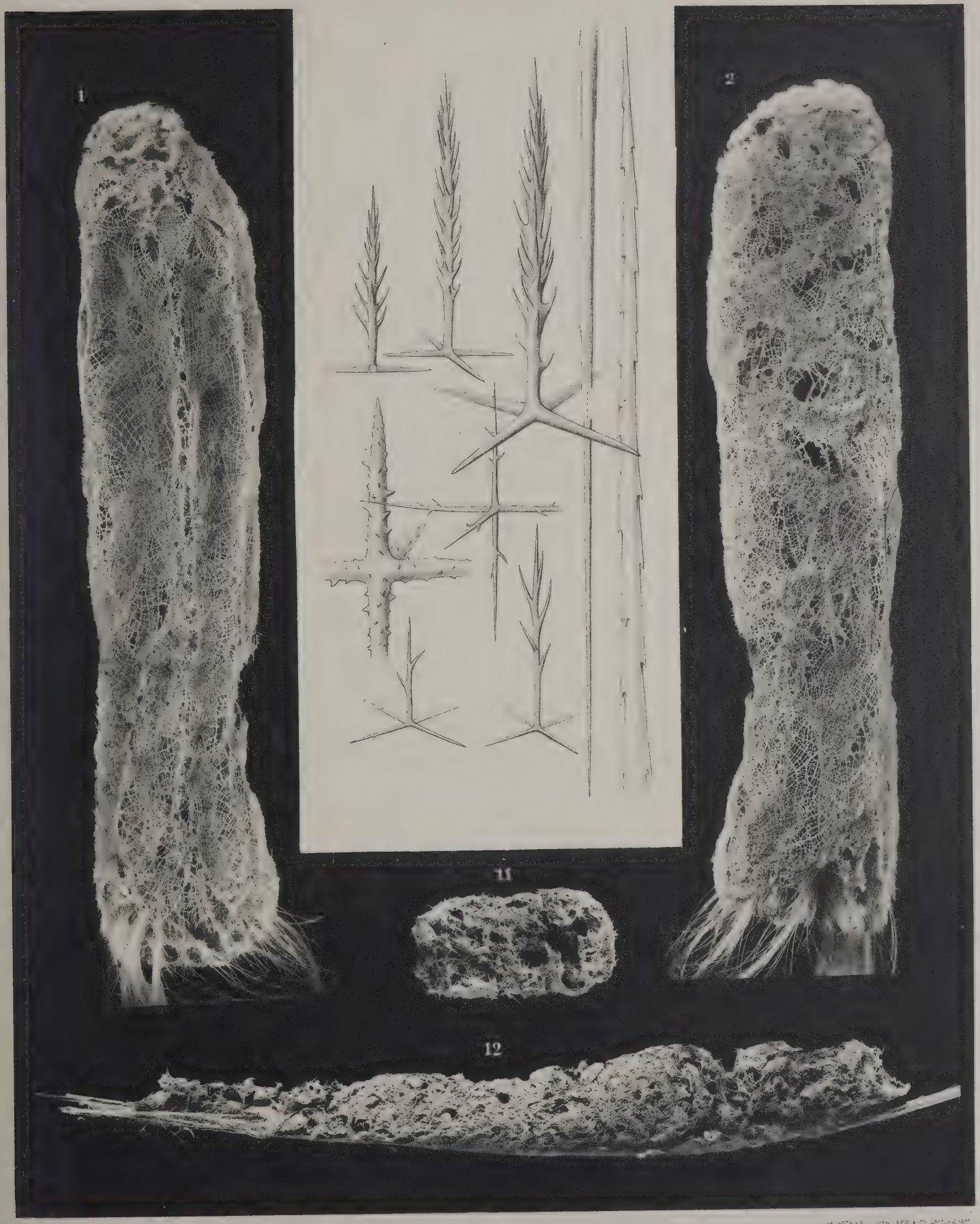
PLATE VI.

Figs. 1—10. *Semperella similis* n. sp.

Fig. 1. The type specimen, from Stat. 122. Seen from the front. About $^1/_2$ natural size.
Fig. 2. The same specimen seen from the back. About $^1/_2$ natural size.
Figs. 3, 4. Two pinules from the dermal lattice. × 300.
Fig. 5. A pinule from the oscular lattice. × 300.
Fig. 6. A slender-rayed intermedial microxypentactin. × 300.
Fig. 7. A stout-rayed intermedial microxypentactin. × 300.
Figs. 8, 9. Two pinule-like canalaria. × 300.
Fig. 10. Parts of a macruncinate. × 300.

Figs. 11—12. *Monorhaphis chuni* F. E. Sch.

Fig. 11. A fragment from Stat. 284, probably the apical end of the specimen shown in the next figure. $^2/_3$ natural size.
Fig. 12. Another specimen from the same station. The left end in the figure is the upper. $^2/_3$ natural size.

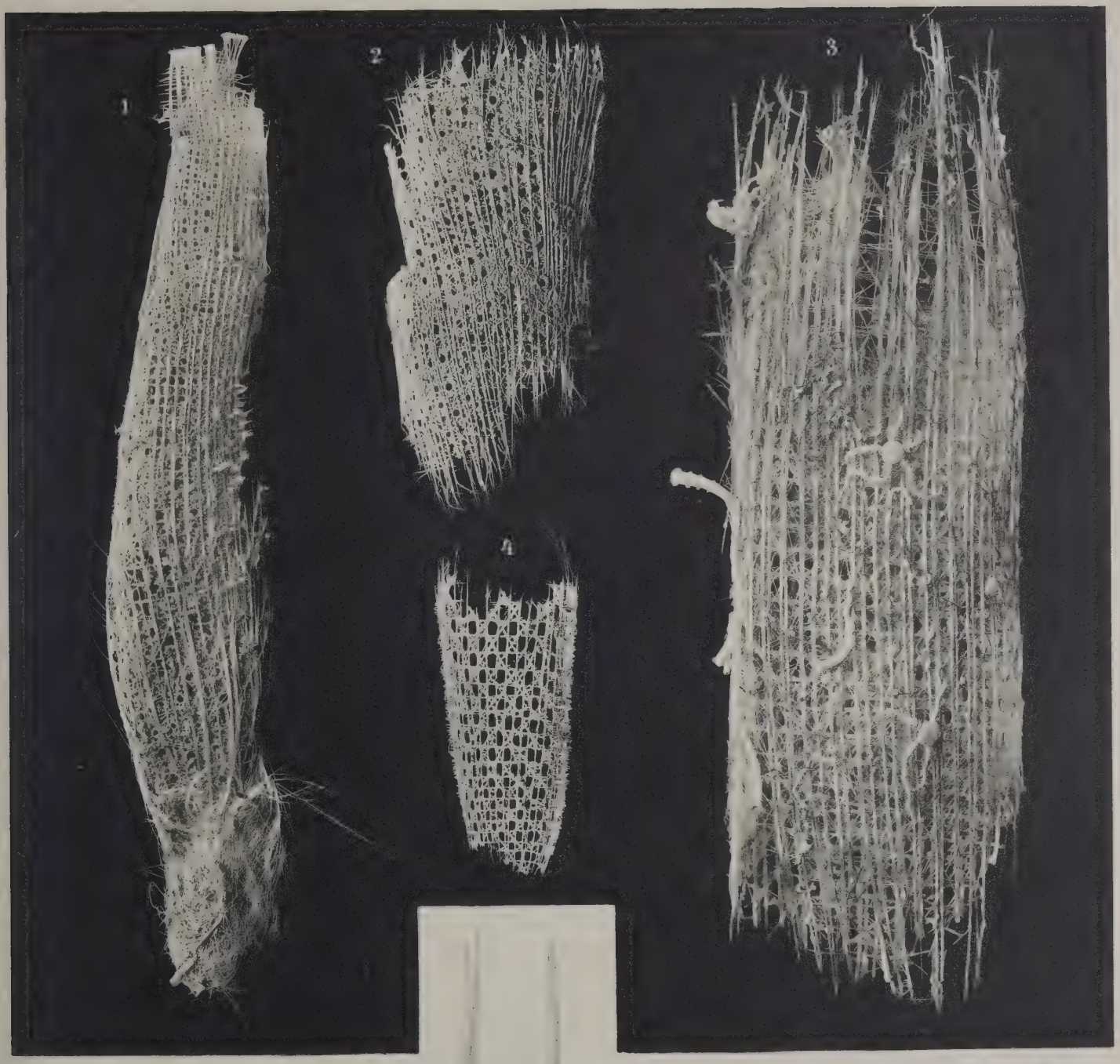


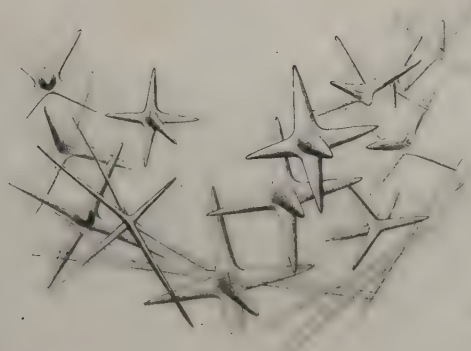
HELIOTYP. E. VAN LEER & Co. AMSTERDAM

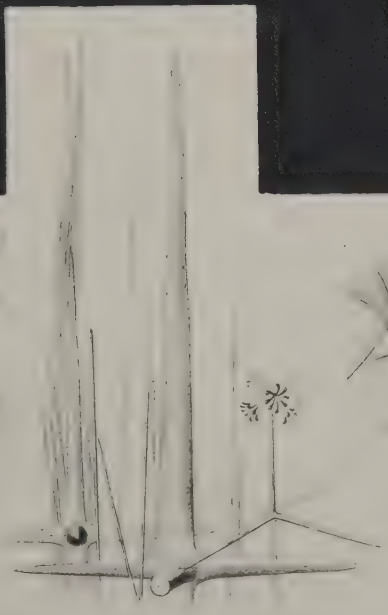
PLATE VII.

Figs. 1—7. *Euplectella timorensis* n. sp.

Fig. 1. The type specimen (A). From Stat. 300. Natural size.
Fig. 2. A fragment of the wall (specimen B). From Stat. 284. Natural size.
Fig. 3. Another fragment of a large individual (specimen E). From Stat. 284. Natural size.
Fig. 4. Basal parts of a skeleton, apparently of this species. From Stat. 289. Natural size.
Fig. 5. A small portion of the oscular membrane of the type specimen (A), to show the oscularia. × 100.
Fig. 6. Same of specimen B. × 100.
Fig. 7. Spicules projecting from the free edge of a parietal ledge. Two strongly developed dermalia accompanied by oxydiactine comitalia. On the right, a dermalia of ordinary dimensions with a floricome on tip of its distal ray.


1
2
3
4





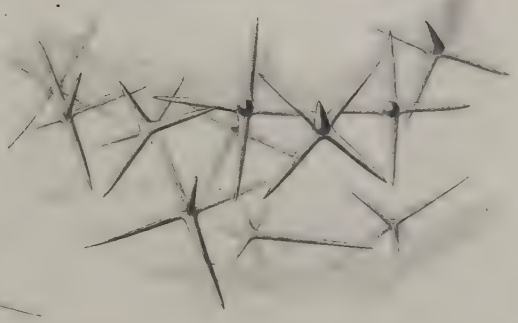


PLATE VIII.

Figs. 1—8. *Bolosoma cavum* n. sp.

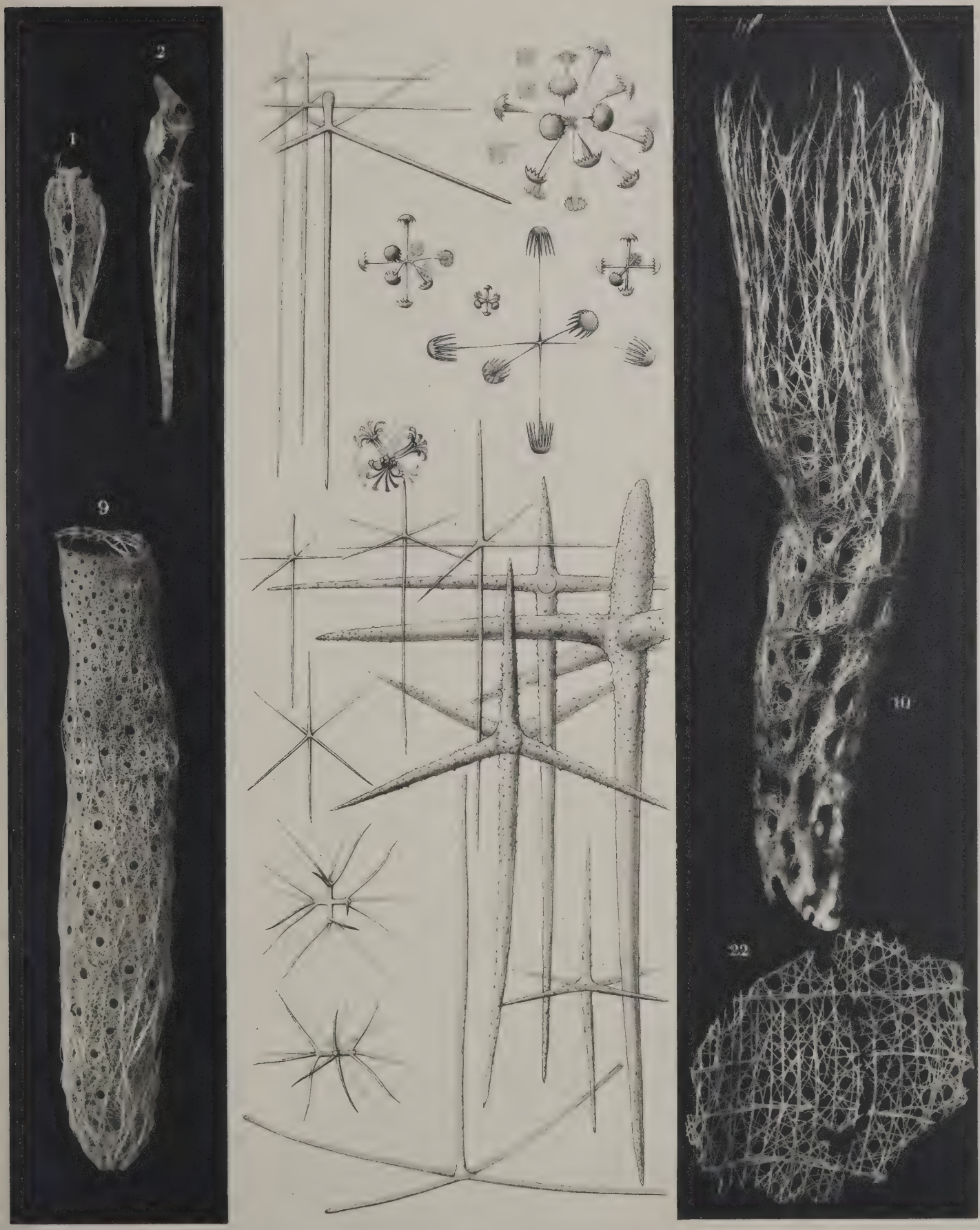
Fig. 1. The type specimen, injured in the upper parts. From Stat. 300. Natural size.
Fig. 2. A very incomplete specimen. From Stat. 177. Natural size.
Fig. 3. Three dermalia from the type specimen. × 150.
Fig. 4. A spherical holodiscohexaster from same. × 300.
Fig. 5. A hemihexactinoid microdiscohexaster from same. × 300.
Figs. 6, 7. Hexactinoid microdiscohexasters from same. × 300.
Fig. 8. A hexactinoid codonhexaster from same. × 300.

Figs. 9—21. *Regadrella cylindrica* n. sp.

Fig. 9. The type specimen. From Stat. 122. Natural size.
Fig. 10. A macerated skeleton from the same station. Nearly but not quite natural size.
Figs. 11—14. Slender-rayed dermalia from the type specimen. × 150.
Figs. 15—18. Large and stout-rayed dermalia from same. × 150.
Fig. 19. A gastralia from same. × 150.
Fig. 20. An oxystauraster from same. × 300.
Fig. 21. The same oxystauraster seen from side. × 300.

Fig. 22. An indeterminable Corbitelline Euplectellid.

Fig. 22. A fragment of skeletal wall, seen from the inner side. From Stat. 251. Natural size.



HELIOTYPIE, L. VAN LEER & Cº AMSTERDAM

PLATE IX.

Figs. 1—5. *Lophocalyx suluanus* n. sp.

Fig. 1. The type specimen. From Stat. 97. Natural size.
Fig. 2. An oxyhexaster from same. × 300.
Fig. 3. A plumicome from same. × 300.
Fig. 4. An autodermalia from same. × 300.
Fig. 5. Schema of spiculation, composed from sections. Above, dermal surface; below, gastral surface. × 50.

Figs. 6—9. *Chaunoplectella stelletta* n. sp.

Fig. 6. The type specimen, seen from front. Stat. 59. Natural size.
Fig. 7. The same specimen, seen from back. Natural size.
Fig. 8. Spiculation of same. Above, dermal spicules of the back, seen surface on; below, spicules of the periphery in side view. × 50.
Fig. 9. A discohexaster from same. × 300.

Figs. 10—14. *Staurocalyptus celebesianus* n. sp.

Fig. 10. The type specimen. Stat. 122. Above, the oscular end. Natural size.
Fig. 11. Three oxyhexasters from same. × 300.
Fig. 12. An autodermalia from same. × 300.
Fig. 13. An autogastralia from same. × 300.
Fig. 14. A discoctaster from same. × 300.

Figs. 15—17. *Bathydorus pedunculatus* n. sp.

Fig. 15. The incomplete type specimen, of which only the ends are drawn. Stat. 122. Natural size.
Fig. 16. An autodermalia, partly drawn, from the upper end of the specimen. × 300.
Fig. 17. Two oxyhexasters from the same specimen. × 300.

Fig. 18. *Caulophacus* sp.

Fig. 18. A macerated incomplete specimen. Stat. 226. Natural size.

Fig. 19. *Leucopsacas scoliodocus* Ij.

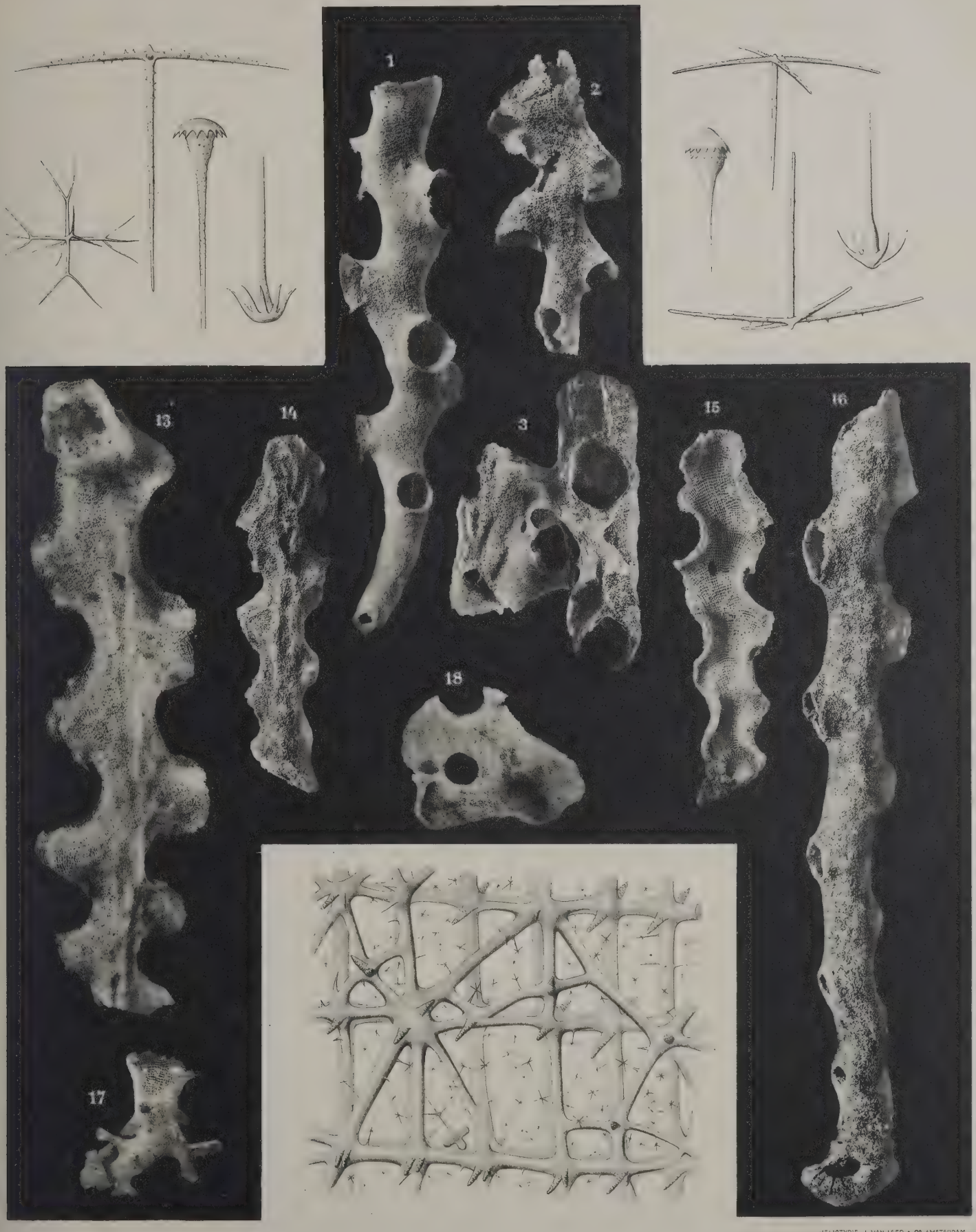
Fig. 19. A small part of a stained section through wall. Above, dermal surface; below, gastral surface. Stat. 289. × 100.

HELIOTYPIE, J. VAN LEER & Cº AMSTERDAM

PLATE X.

Figs. 1—12. *Farrea occa erecta* n. subsp.

Fig. 1. The type specimen A., from Stat. 220. Natural size.
Fig. 2. A specimen (E) from Stat. 122. Natural size.
Fig. 3. A specimen (C) attached to a piece of an old dead *Farrea* tube (on the right of the figure). Natural size.
Figs. 4—8. Spicules from the type specimen shown in fig. 1.
Fig. 4. A dermalia. × 100.
Fig. 5. An oxyhexaster. × 300.
Fig. 6. A dermal clavule. × 450.
Fig. 7. A gastral clavule. × 450.
Fig. 8. Dictyonal framework seen from the outer side. × 45.
Figs. 9—12. Spicules from the specimen (C) shown in fig. 3.
Fig. 9. A dermalia. × 100.
Fig. 10. A dermal clavule. × 450.
Fig. 11. A gastral clavule. × 450.
Fig. 12. A gastralia. × 100.
Fig. 13—16. Dead or completely washed-out *Farrea* skeleton, apparently either *F. occa erecta* n. subsp. or *F. occa clavigera* F. E. Sch., but not exactly determinable on account of the absence of loose spicules.
Fig. 13. The upper part of a stock from Stat. 122. Natural size.
Figs. 14, 15. The basal part of a stock from the same station. Skeletal tube sawed into two longitudinal halves and the same half seen from external and internal sides respectively. Natural size.
Fig. 16. The dead and corroded basal part of a stock from Stat. 226. Natural size.
Fig. 17. *Farrea* sp. from Stat. 208; possibly *F. lendenfeldi* n. sp., but not definitely determinable. Natural size.
Fig. 18. An indeterminable washed-out skeleton from Stat. 280, referred with doubt to the Farreinae; possibly *Lonchipora* sp. Natural size.



HELIOTYPIE, L VAN LEER & Cº AMSTERDAM

PLATE XI.

Figs. 1—11. *Farrea occa clavigera* F. E. Sch.

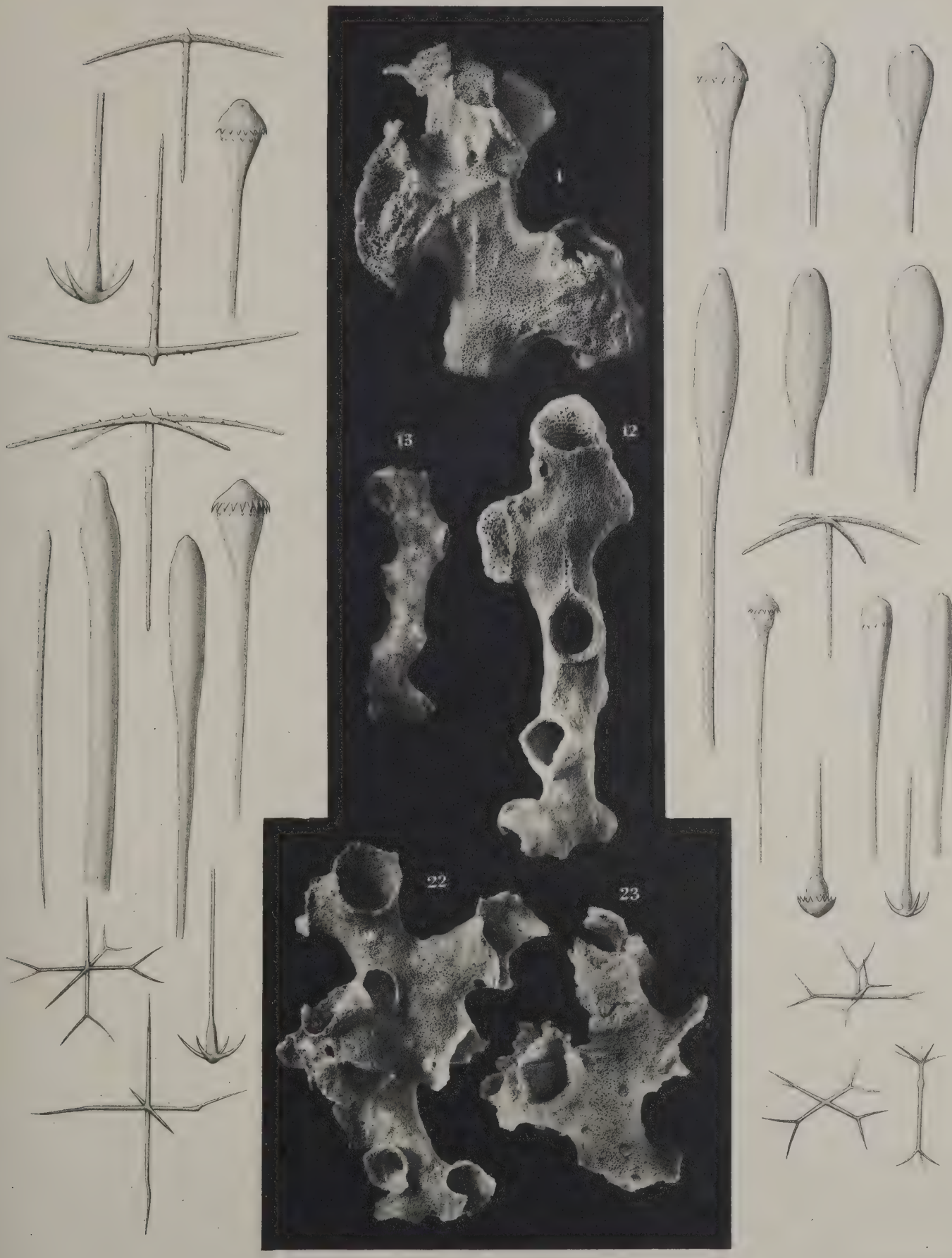
Fig. 1. Upper end of a large stock from Stat. 226. Natural size.
Figs. 2—11. Some spicules from the above specimen.
Figs. 2, 3. A dermalia and a gastralia respectively. × 100.
Fig. 4. A gastral clavule. × 450.
Figs. 5—11. Dermal clavules. × 450.
Fig. 5. The common form of pileate dermal clavule.
Figs. 6, 7. Rare forms of same, grading over into the smooth-clavate form.
Figs. 8—11. Variations of smooth-clavate dermal clavule. Fig. 10. The commonest form of same.

Figs. 12—21. *Farrea occa subclavigera* n. subsp.

Fig. 12. The type specimen. Stat. 267. Natural size.
Fig. 13. A macerated specimen from the same station and apparently belonging to the same subspecies, with lateral oscula in alternately opposite arrangement. Natural size.
Figs. 14—21. Spicules from the type specimen shown in fig. 12.
Fig. 14. A dermalia. × 100.
Fig. 15. An anguilliform clavule, the commonest form of dermal clavule. × 100.
Fig. 16. Distal parts of same. × 450.
Figs. 17, 18. Smooth-clavate and pileate dermal clavules of occasional occurrence. × 450.
Fig. 19. An anchorate gastral clavule. × 450.
Fig. 20. A hemioxyhexaster of frequent occurrence among the oxyhexasters. × 300.
Fig. 21. A hexactinoid oxyhexaster of rare occurrence. × 300.

Figs. 22—32. *Farrea occa mammillata* n. subsp.

Figs. 22, 23. Two largest specimens from Stat. 297.
Figs. 24—32. Some spicules from one of the above specimens.
Fig. 24. A dermalia. × 100.
Fig. 25. The commonest form of dermal clavule.
Fig. 26. A case found of the transition of the smooth-clavate dermal clavule into the pileate.
Fig. 27. The pileate dermal clavule of occasional occurrence.
Fig. 28. The commonest form of gastral clavule (pileate). × 450.
Fig. 29. The anchorate gastral clavule of a less frequent occurrence. × 450.
Figs. 30—32. Rarely occurring forms of oxyhexaster. × 300.
Fig. 30. An oxypentaster.
Fig. 31. An oxystauraster.
Fig. 32. An oxydiaster.



HELIOTYPIE, L. VAN LEER & Co AMSTERDAM

PLATE XII.

Figs. 1—8. *Farrea occa cuspidata* n. subsp.

Fig. 1. The type specimen from Stat. 262. Natural size.
Fig. 2. Another specimen from the same station. Natural size.
Figs. 3—8. Spicules from the type specimen.
Fig. 3. A dermal pentactin. × 300.
Fig. 4. Paratangential ray of same seen from the distal side. × 300.
Fig. 5. Head of a cusped-clavate dermal clavule. × 450.
Fig. 6. Apical end of same with the axial canal and cross drawn in. × 450.
Fig. 7. Peripheralmost dictyonal beams seen from the outside, showing tuberculation on them. × 45.
Fig. 8. Innermost lattice layer of the dictyonal skeleton seen from the gastral side. × 45.

Figs. 9—21. *Farrea occa ouwensi* n. subsp.

Fig. 9. The type specimen from Stat. 122. Natural size.
Fig. 10. Another specimen from Stat. 119. Natural size.
Figs. 11—13. A pileate dermal clavule (× 450) and two tylohexasters (× 300) from the type specimen shown in fig. 9.
Figs. 14, 15. A small portion of the external superficial parts of the dictyonal skeleton seen from the dermal side (× 70), and a pileate dermal clavule (× 450); from the specimen shown in fig. 10.
Figs. 16—21. A pileate dermal clavule (× 450) and hexaster varieties (× 300) from still another specimen obtained at Stat. 124.

Figs. 22—30. *Farrea nodulosa* n. sp.

Fig. 22. The type specimen, from Stat. 95. Natural size.
Figs. 23—30. Spicules from the above type specimen.
Fig. 23. A dermal pentactin. × 100.
Fig. 24. Paratangential ray of same seen from the distal side. × 300.
Fig. 25. A gastral pentactin and a gastral clavule. × 100.
Fig. 26. An oxyhexaster. × 300.
Fig. 27. A pileate dermal clavule. × 440.
Figs. 28, 29. Two anchorate gastral clavules. × 440.
Fig. 30. A small portion of the single-layered dictyonal latticework, with external and internal spikes consisting each of a basal boss and a terminal process. × 100.

HELIOTYPIE, L VAN LEER & Cº AMSTERDAM

PLATE XIII.

Figs. 1—9. *Farrea hanitschi* n. sp.

Figs. 1—9. Spicules from the type specimen, from Timor Sea.

Fig. 1. A small portion of the dictyonal skeleton with some loose spicules. × 70.

Fig. 2. A dermal pentactin. × 300.

Fig. 3. Paratangential ray of same seen from the distal side. × 300.

Fig. 4. An oxyhexaster. × 450.

Figs. 5, 6. Two discohexasters.

Fig. 7. A pileate dermal clavule. × 450.

Fig. 8. Portion of a large uncinate. × 300.

Fig. 9. An anchorate clavule, probably gastral. × 450.

Figs. 10—15. *Farrea spirifera* n. sp.

Fig. 10. The type specimen, from Stat. 267. Natural size.

Figs. 11—13. Spicules from the above type specimen.

Fig. 11. an oxyhexaster of a common size. × 300.

Fig. 12. A pileate dermal clavule. × 450.

Fig. 13. A spiro-anchorate gastral clavule. × 450.

Fig. 14. A spiro-anchorate dermal clavule from a second specimen of the species from the same station. × 450.

Fig. 15. Head of the same clavule as above, looked at from above the top. × 450.

Figs. 16—27. *Farrea lendenfeldi* n. sp.

Fig. 16. The type specimen, from Stat. 267. Natural size.

Figs. 17—27. Spicules from the above type specimen.

Figs. 17, 18. A small and a large pileate-anchorate gastral clavule. × 450. (another is shown in fig. 27).

Figs. 19, 20. Two oxyhexasters. × 450.

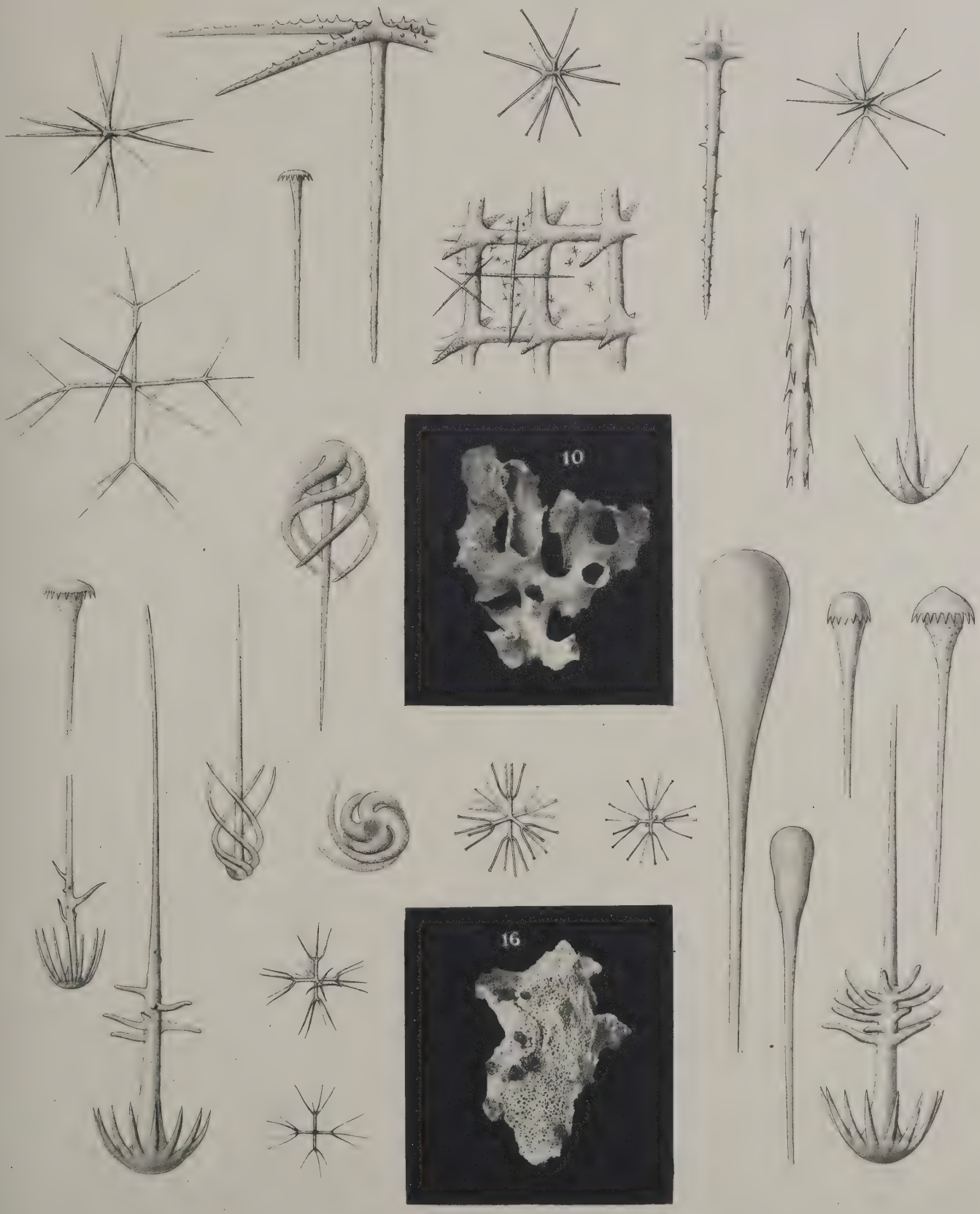
Figs. 21, 22. Two tylohexasters. × 450.

Figs. 23, 24. The commonest form of dermal clavule. × 450.

Fig. 25. A dermal clavule with a circle of teeth, but approaching the form of fig. 24, × 450.

Fig. 26. A typically pileate dermal clavule of rare occurrence. × 450.

Fig. 27. A large pileate-anchorate gastral clavule with an unusually large number of finger-like processes on the shaft. × 450.



HELIOTYPIE VAN LEER & Cº AMSTERDAM

PLATE XIV.

Figs. 1—12. *Periphragella parva* n. sp.

Figs. 1—3. Three specimens from Stat. 267. Natural size.
Fig. 4. A dermalia with slender and obsoletely rough rays. × 300.
Fig. 5. Another dermalia with stronger and densely spiny dermalia. × 300.
Fig. 6. A dermal scopule. × 450.
Fig. 7. A gastral scopule. × 450.
Figs. 8, 9. Tylohexasters. × 450.
Fig. 10. Superficial parts of skeleton, seen on external surface; with some loose spicules (dermalia, etc.) in situ. × 70.
Figs. 11, 12. Oxyhexasters. × 450.

Figs. 13—20. *Periphragella irregularis* n. sp.

Fig. 13. The type specimen in lateral view, attached on a piece of dead *Farrea* tube. From Stat. 156. Natural size.
Figs. 14, 15. Another specimen from the same station, bleached.
Fig. 14. Lateral view.
Fig. 15. The same seen from above. Natural size.
Fig. 16. A dermalia. × 100.
Fig. 17. An oxyhexaster. × 440.
Figs. 18, 19. Scopules from the gastral side. × 440.
Fig. 20. Section of the wall. Above, the dermal surface. × 70.

Figs. 21—24. *Eurete marshalli* F. E. Sch.

Fig. 21. A specimen from Stat. 260. Natural size.
Fig. 22. An oxyhexaster. × 450.
Fig. 23. Scopules. × 450.
Fig. 24. Superficial parts of skeleton, seen on external surface. × 70.

Figs. 25—29. *Eurete trachydocus* n. sp.

Fig. 25. The type specimen. From Stat. 251. Natural size.
Fig. 26. Superficial parts of skeleton, seen external surface on; with some loose spicules of the dermal layer. × 70.
Fig. 27. An oxyhexaster. × 450.
Figs. 28, 29. Scopules. × 450.

Figs. 30—35. *Eurete schmidti kampeni* n. subsp.

Figs. 30, 31. Two specimens from Stat. 251. Both attached on worm tube. Natural size.
Figs. 32, 33. Oxyhexasters. × 450.
Fig. 34. Dermal scopules with finely pointed end-prongs. × 450.
Fig. 35. Dermal scopules with end-prongs bulbously swollen at end. × 450.

HELIOTYPIE, L VAN LEER & Cº AMSTERDAM

PLATE XV.

Figs. 1—10. *Eurete schmidti treubi* n. subsp.

Fig. 1. The type specimen. From Stat. 251. Natural size (Figs. 3—10 were all taken from this specimen).
Fig. 2. Another specimen from Stat. 297, representing parts of a stock in which the branches are in most parts solid and many old oscula are nearly or quite closed up. Below in the figure is seen basal attachment. Nat. size.
Figs. 3, 4. Dermal scopules. × 450.
Figs. 5, 6. Gastral scopules. × 450.
Fig. 7. An oxyhexaster. × 450.
Fig. 8. Two views of a part of a large uncinate with barbs in two opposite longitudinal rows. × 450.
Fig. 9. Superficial dictyonal beams and nodes of the dermal side of the wall, seen surface on; with some dermalia and scopules drawn in, to show relative dimensions. × 70.
Fig. 10. Same of the gastral side, seen on surface; with a gastralia and a scōpule drawn in. × 70.

Figs. 11—13. *Eurete schmidti schmidti* F. E. Sch.

Figs. 11—13. The two kinds of dermal scopules from a specimen obtained in the Sagami Sea and preserved in the Science College of the Tokyo Imperial University (spec. No. 274). × 450.

Figs. 14—24. *Eurete freelandi* n. sp.

Figs. 14, 15. Two fragmentary specimens from Stat. 105. Natural size.
Fig. 16. Sectional representation of the spiculation. Above, the dermal surface. Below, the gastral surface × 70.
Figs. 17—20. Dermal scopules. × 450.
Fig. 21. A gastral scopule. × 450.
Figs. 22—24. Hemioxyhexasters. × 450.

Figs. 25—31. *Pararete kangeanganum* n. sp.

Fig. 25. A strongly developed gastral pentactin; the paired rays seen on the side opposite the unpaired ray. × 300.
Fig. 26. Part of a weakly developed gastral pentactin seen in the same way. × 300.
Figs. 27, 28. Scopules. × 450.
Fig. 29. A free oxyhexactin. × 300.
Fig. 30. A discohexaster. × 450.
Fig. 31. Superficial dictyonal beams and nodes of the dermal side, seen surface on; two dermalia and a number of free oxyhexactins in situ. × 70.

HELIOTYP.E. L VAN LEER & Cº AMSTERDAM

PLATE XVI.

Figs. 1—6. *Pararete farreopsis farreopsis* (Cart.).

Fig. 1. A well preserved specimen from Stat. 251. Natural size.
Fig. 2. A piece of a completely macerated branch from the same station. Natural size.
Fig. 3. A scopule. × 450.
Figs. 4, 5. Discohexasters. × 450.
Fig. 6. Sectional representation of the spiculation. Above, dermal surface. Below, gastral surface. × 70.

Figs. 7—12. *Pararete baliense* n. sp.

Fig. 7. The type specimen. From Stat. 15. Natural size.
Fig. 8. A small part of the skeleton seen on the dermal surface. × 70.
Figs. 9—12. Examples of the scopules. × 450.

Figs. 13—18. *Pararete farreopsis fragiferum* n. subsp.

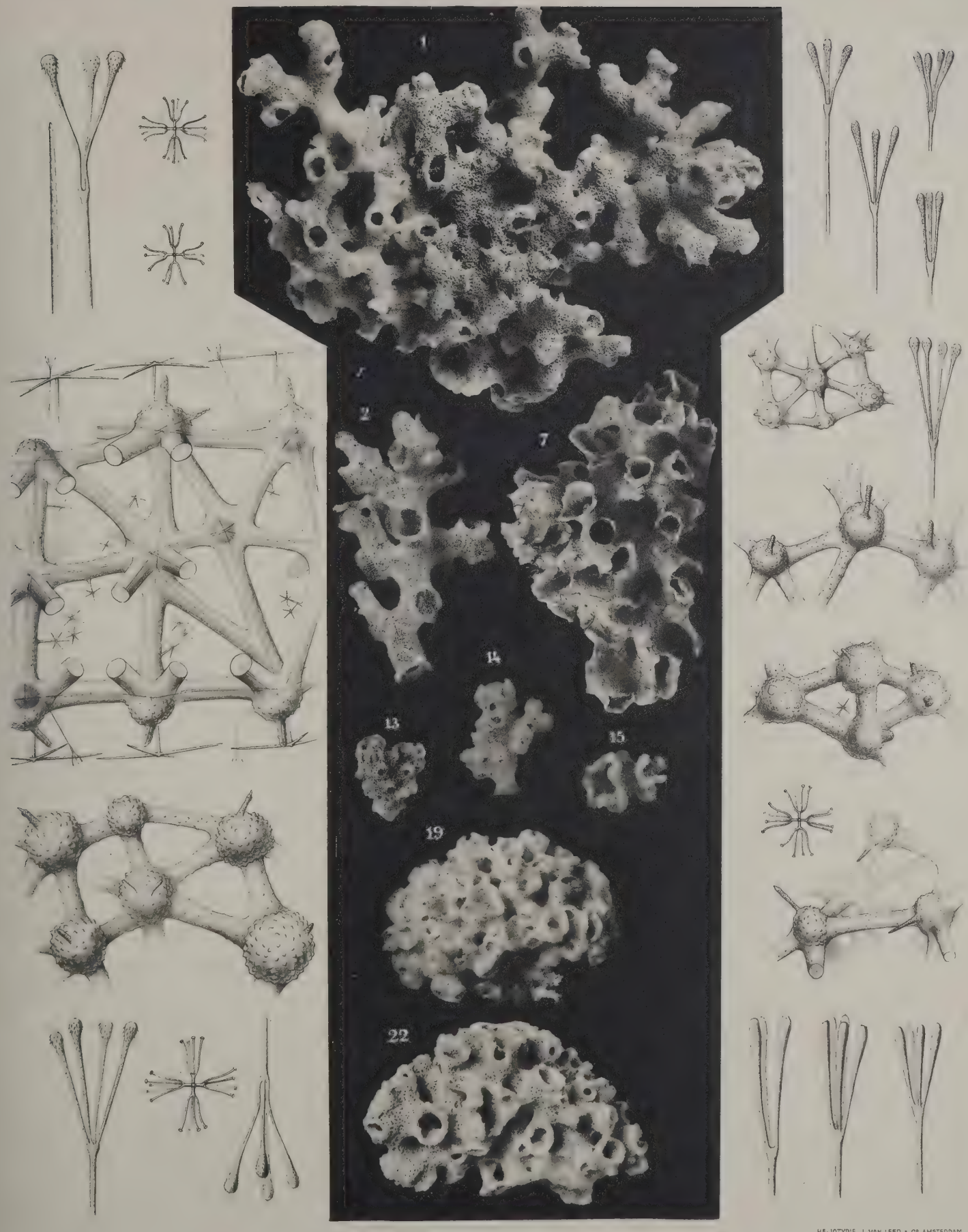
Fig. 13. The type specimen. From Stat. 156. Natural size.
Fig. 14. Another specimen, macerated, in side view. From the same station. Natural size.
Fig. 15. The same specimen as above seen on top. Natural size.
Fig. 16. A small part of the skeleton seen on the dermal surface. × 70.
Fig. 17. A dermal scopule. × 450.
Fig. 18. A discohexaster. × 450.

Figs. 19—21. *Pararete farreopsis subglobosum* n. subsp.

Fig. 19. The type specimen in the Science College, Tokyo. From China Sea, south of Hainan. Mr. MACLEAR LADDS coll. Nat. size.
Fig. 20. A small part of the skeleton seen on the dermal surface. × 70.
Fig. 21. A large scopule. × 450.

Figs. 22—29. *Pararete semperi* (F. E. Sch.).

Fig. 22. A specimen from Stat. 251. Natural size.
Fig. 23. A small part of the skelèton seen on the dermal surface. × 70.
Fig. 24. Same seen on the gastral surface. × 70.
Fig. 25. A discohexaster. × 450.
Fig. 26. A gastral scopule. × 450.
Fig. 27—29. Examples of the dermal scopule. × 450.



HELIOTYPIE, L. VAN LEER & Cº AMSTERDAM

PLATE XVII.

Figs. 1—7. *Pararete farreopsis jakosalemi* n. subsp.

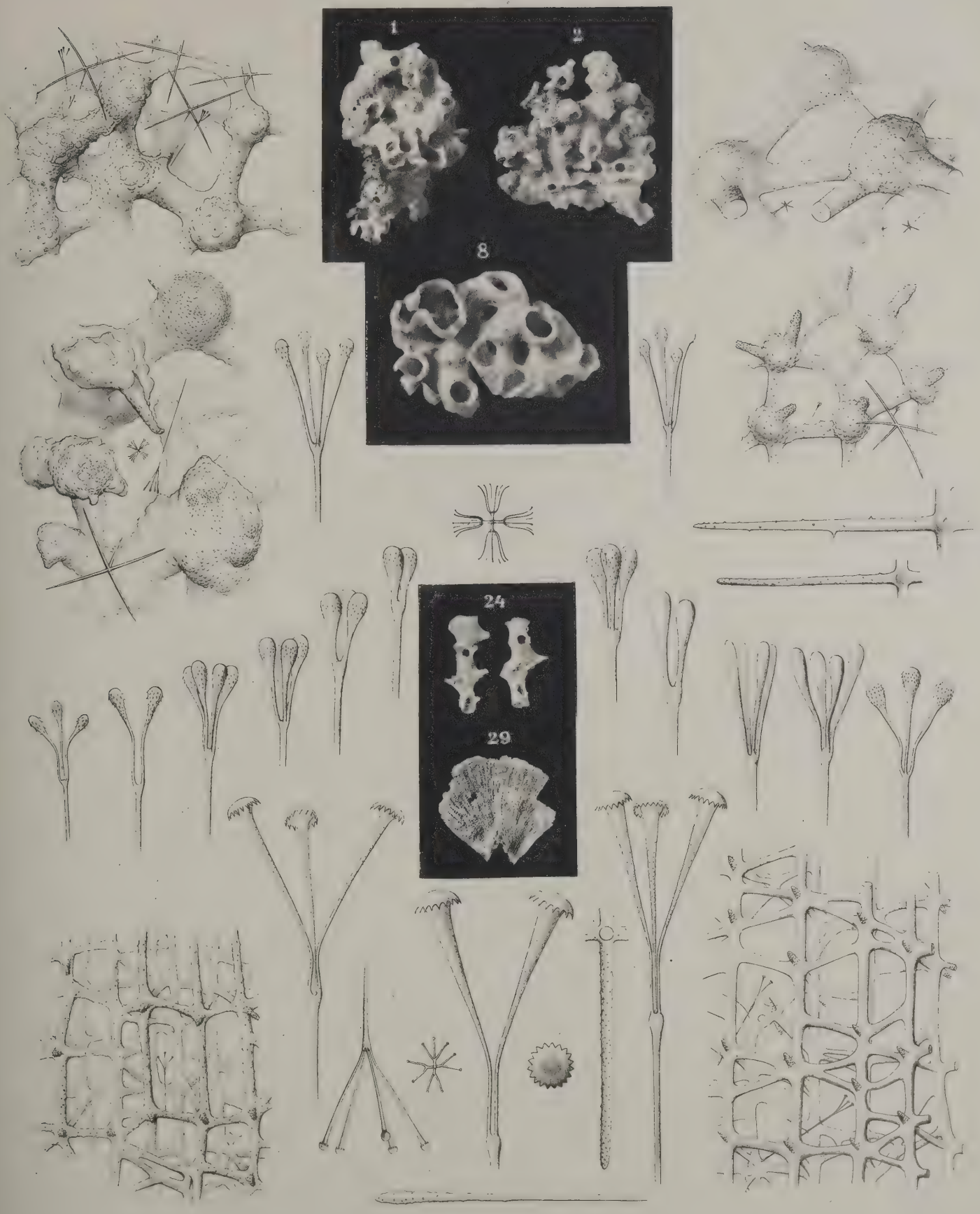
Figs. 1, 2. Two of the specimens from Stat. 97. Natural size.
Figs. 3—5. Small parts of the skeleton seen on the dermal surface, showing superficial nodal bosses. In figs. 3 and 4 some dermalia and other loose spicules were drawn in. × 70.
Figs. 6, 7. Scopules. × 450.

Figs. 8—23. *Pararete freeri* n. sp.

Fig. 8. The type specimen. From Stat. 97. Natural size. (All the spicules of figs. 9—18 are from this specimen).
Fig. 9. A small part of the skeleton seen on the dermal side. × 70.
Fig. 10. Paired rays of a gastral pentactin seen on the side opposite the unpaired ray. × 300.
Fig. 11. Paired rays of an average-sized dermal pentactin seen in the same way as above. × 300.
Fig. 12. A discohexaster of a rather large size. × 450.
Figs. 13—16. Examples of the dermal. × 450.
Figs. 13—15. Forms characteristic of the species.
Fig. 16. A form approaching that of typical *P. farreopsis*.
Figs. 17, 18. Gastral spicules. × 450.
Figs. 19—23. Dermal scopules from a fragmentary specimen obtained at the same station as the type of the species and referred to that species though showing some points of deviation in the character of some spicules. × 450.

Figs. 24—34. *Pleurochorium cornutum* n. sp.

Fig. 24. The two specimens from Stat. 297. Natural size.
Fig. 25. Scopule, common form of. × 450.
Fig. 26. Small form of scopule found on the gastral side. × 450.
Fig. 27. A discohexaster. × 450.
Fig. 28. A small part of the skeleton seen from the dermal side. × 70.
Fig. 29. The type specimen. From Stat. 297. Natural size.
Figs. 30, 31. Scopules. × 450.
Fig. 32. Terminal disc of the scopule seen on top. × 450.
Fig. 33. Dermal or gastral pentactin, paired rays of, seen on the side opposite the unpaired ray. × 300.
Fig. 34. A small part of the skeleton from near free margin of body. × 70.



HELIOTYPIE, L. VAN LEER & Cº AMSTERDAM

PLATE XVIII.

Figs. 1—2. *Hexactinella lata* (F. E. Sch.).

Fig. 1. A fragment of wall, seen on the dermal (convex) side. From Stat. 251. Natural size.
Fig. 2. The same fragment seen on the gastral (convex) side. Natural size.

Figs. 3—6. *Hexactinella vermiculosa* n. sp.

Fig. 3. The largest fragment seen on the dermal side. From Stat. 89. Natural size.
Fig. 4. The same fragment seen on the gastral side. Natural size.
Fig. 5. The same fragment seen on one of the lateral broken edges. The convex side is the gastral. Natural size.
Fig. 6. A small part of the skeleton at the free edge of choanosomal septum. × 100.

Fig. 7—10. *Hexactinella rugosa* n. sp.

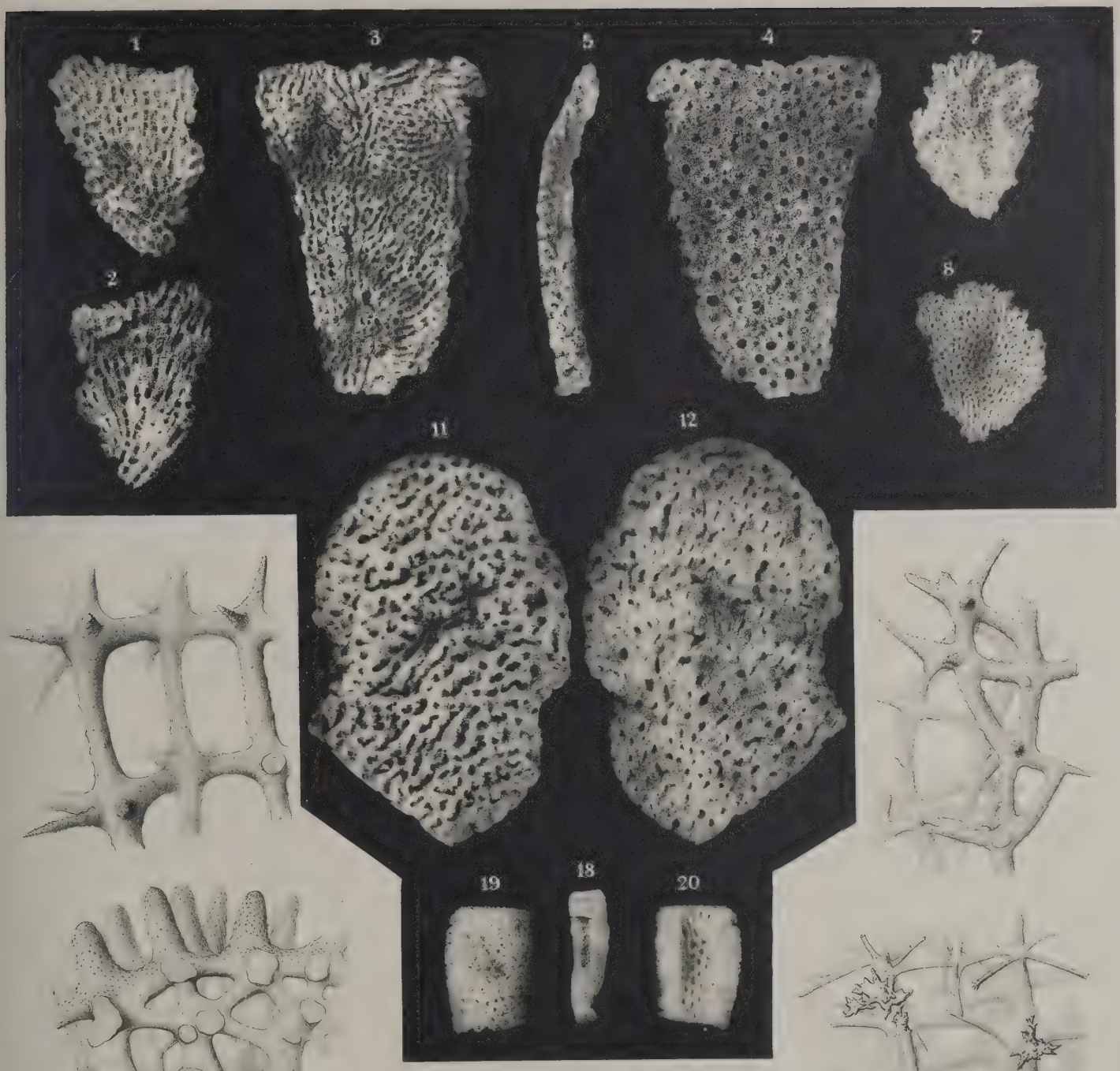
Fig. 7. A fragment of wall, seen on the dermal side. From Stat. 260. Natural size.
Fig. 8. The same fragment seen on the gastral side. Natural size.
Fig. 9. Dictyonal reticulum composing the ridges of the dermal surface of skeleton. × 70.
Fig. 10. A scopule, probably proper to the species. × 450.

Figs. 11—17. *Hexactinella lingua* n. sp.

Fig. 11. The type specimen seen on the dermal side. From Stat. 251. Natural size.
Fig. 12. The same specimen seen on the gastral side. Natural size.
Fig. 13. Part of a section through choanosomal skeletal septum. Above, dermal edge of septum, with stout spikes. A scopule and some rhaphidial uncinates in situ. × 70.
Fig. 14. Dictyonal reticulum composing the snowflake-like processes which project into dermal diarhysial apertures from skeletal septa. × 70.
Fig. 15. Lateral surface of skeletal septum, with a number of secondarily added spiny hexactins. × 70.
Fig. 16. A discohexaster not improbably proper to the species. × 440.
Fig. 17. A scopule of a medium size. × 440.

Figs. 18—21. *Tretorete incertum* n. g., n. sp.

Fig. 18. One of the specimens, from Stat. 105. Natural size.
Fig. 19. A cleaned fragment of wall, seen on the dermal side. × 2.
Fig. 20. The same fragment seen on the gastral side; the wall in longitudinal section. × 2.
Fig. 21. A small part of a section through the periphery of skeletal wall. Above, dermal surface with spikes broken off, except one. × 80.



HELIOTYPIE, L VAN LEER & Cº AMSTERDAM

PLATE XIX.

Figs. 1—4. *Tretodictyum tubulosum* F. E. Sch.
From a specimen obtained by Mr. MACLEAR LADDS in China Sea.

Fig. 1. An oxyhexaster. × 450.
Fig. 2. A gastral scopule. × 450.
Fig. 3. A strongly developed dermal scopule. × 450.
Fig. 4. A small part of a dermal uncinate, from the inner half of its length. × 450.

Figs. 5—7. *Hexactinella? spongiosa* n. sp.

Fig. 5. The type specimen from Stat. 251, in lateral view. Natural size.
Fig. 6. The same specimen seen from above; osculum in the middle. Natural size.
Fig. 7. A small part of the dictyonal skeleton; dermal spikes above. × 70.

Figs. 8—14. *Tretodictyum pumicosum* n. sp.

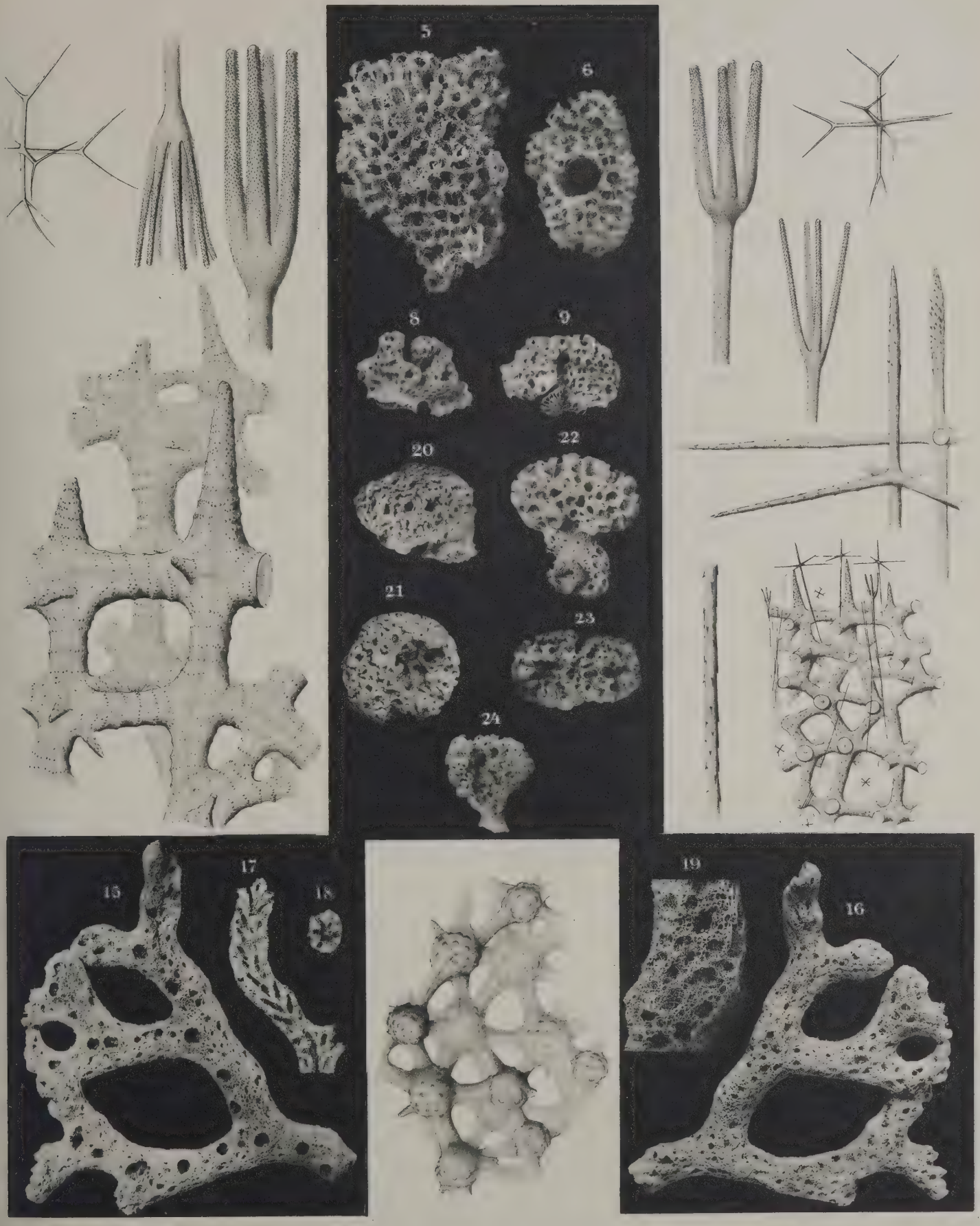
Fig. 8. The type specimen in lateral view. From Stat. 260. Natural size.
Fig. 9. A completely washed-out specimen from the same station. Natural size.
Figs. 10, 11. Two dermal scopules. × 450.
Fig. 12. An oxyhexaster. × 450.
Fig. 13. Two dermal hexactins. × 450.
Fig. 14. Composed sectional representation of the spiculation; dermal surface above. × 70.

Figs. 15—19. *Tretodictyum schrammeni* n. sp.
More figures of this species are given in Plate XX.

Fig. 15. A large fragment from Stat. 297, seen on the oscular side. The large apertures in a uniserial row are oscular openings; all the rest are external entrances into diarhyses. Natural size.
Fig. 16. The same specimen seen on the aboscular side. All the larger openings seen on this side are entrances into diarhyses; none oscular apertures. Natural size.
Fig. 17. A piece of a completely washed-out branch in longitudinal section through the axis. Natural size.
Fig. 18. Same in cross-section. Natural size.
Fig. 19. A part of aboscular surface, magnified twice the natural size; showing partially preserved dermal lattice covering over diarhysial apertures. The layer will be best recognized by examining the figure under the hand-lens.

Figs. 20—25. *Anomochone globosa* n. g., n. sp.

Fig. 20. The type specimen in lateral view. From Stat. 251. Natural size.
Fig. 21. The same specimen seen from above. Natural size.
Fig. 22. A cotype from the same station. Lateral view. Natural size.
Fig. 23. The same specimen seen from above. Natural size.
Fig. 24. Another cotype from the same station longitudinally cut and seen on the cut surface with exposed gastral cavity. Natural size.
Fig. 25. Surface view of the dictyonal skeleton, showing superficially situated nodal thickenings with spikes. × 70.



HELIOTYPIE, L VAN LEER & Cº AMSTERDAM

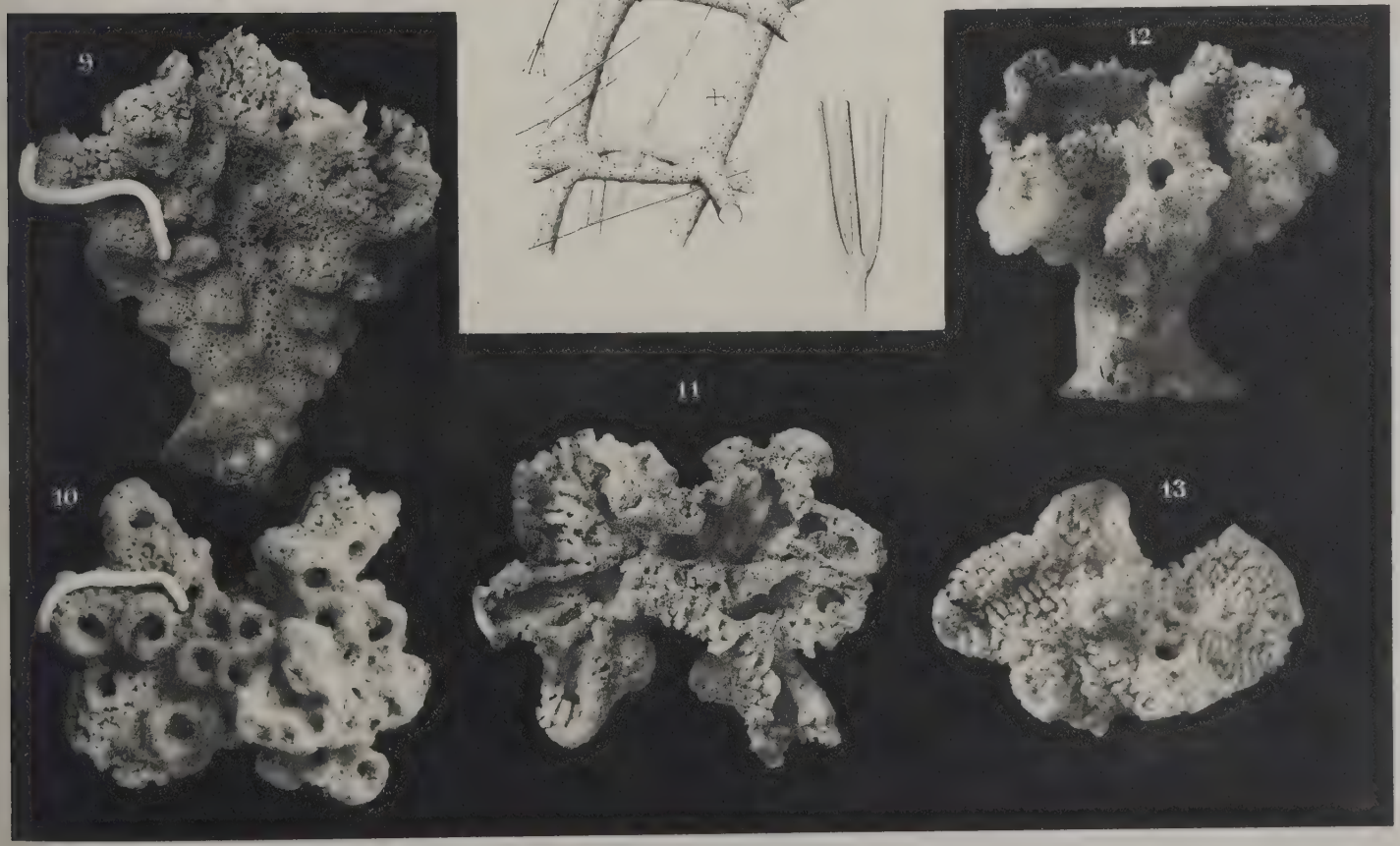
PLATE XX.

Figs. 1—8. *Tretodictyum schrammeni* n. sp.
Continued from Pl. XIX, fig. 19.

Fig. 1. Sectional representation of the spiculation; layer of dermalia above. Composed. × 70.
Fig. 2. Dermalia of widely different development. *a*, a very strongly developed one. *b*, *c*, two small ones. *d*. one with pinularly developed outer ray. × 100.
Fig. 3. A small part of a large uncinate. × 450.
Figs. 4, 5. Oxyhexasters. × 450.
Fig. 6. Dermal scopule. × 450.
Figs. 7, 8. Canalar scopules. × 450.

Figs. 9—16. *Anomochone expansa* n. g., n. sp.

Fig. 9. Specimen A in lateral view. Stat. 251. Natural size.
Fig. 10. The same specimen seen from below. Natural size.
Fig. 11. The same specimen seen from above. Natural size.
Fig. 12. Specimen B from the same station, in lateral view. Natural size.
Fig. 13. Specimen D, a fragment, seen on the dermal surface; oscular margin above. Slightly larger than natural size.
Fig. 14. Dictyonal framework as seen from the external (dermal) side. × 70.
Fig. 15. Covering dictyonal layer of gastral surface. × 70.
Fig. 16. A scopule from Specimen D. × 440.



HELIOTYPIE C. VAN LEER & Cie AMSTERDAM

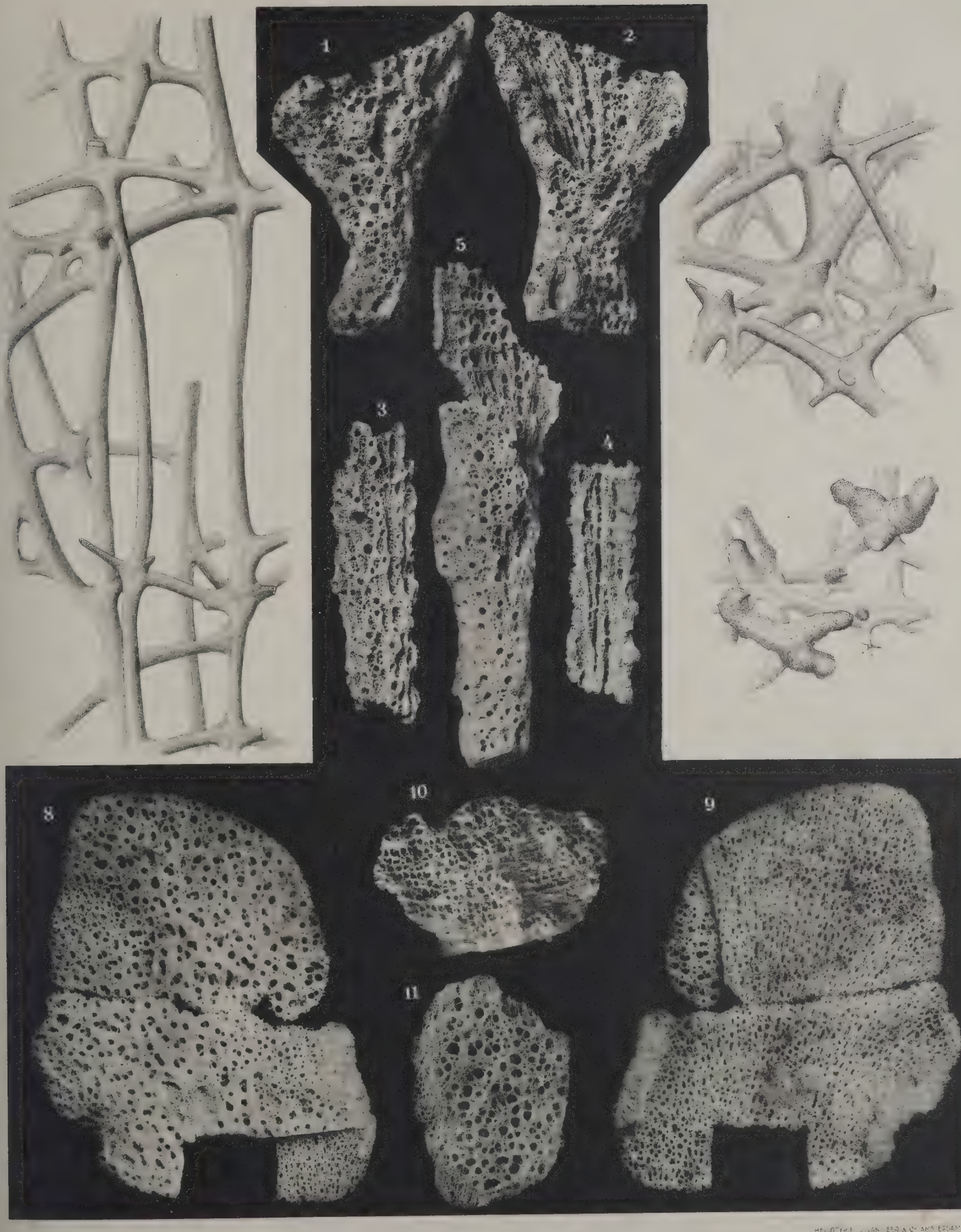
PLATE XXI.

Figs. 1—7. *Lefroyella ceramensis* n. sp.

Fig. 1. A specimen from Stat. 266. Side view. Natural size.
Fig. 2. The same specimen in another side view. Natural size.
Fig. 3. The type specimen in dermal view. From Stat. 177. Natural size.
Fig. 4. The same specimen longitudinally divided and seen from the gastral side. Natural size.
Fig. 5. A second specimen from Stat. 266. Gastral side exposed to view at the upper end. Natural size.
Fig. 6. Irregularly trellis-like dictyonal tissue from the gastral side of wall. From the type specimen. × 70.
Fig. 7. External superficial dictyonal tissue seen from the dermal side. From the type specimen. × 70.

Figs. 8—12. *Tretopleura candelabrum* n. g., n. sp.

Fig. 8. The type specimen seen from the gastral side. From Stat. 226. A horizontal slice of wall was removed from the gastral side at the right corner below. Natural size.
Fig. 9. The same specimen seen from the dermal side. A horizontal slice of wall removed from the dermal side at the left of the upper parts. Natural size.
Fig. 10. A fragment from the same station. Dermal view. Damaged in one part, revealing the longitudinally fibrous structure of skeleton in the inner parts. Natural size.
Fig. 11. The same fragment in gastral view. Natural size.
Fig. 12. Some irregularly swollen dermal spikes and superficial dictyonal beams in connection therewith, looked at from the outside. × 70.



HELIOTYPE E. VAN BERG & Cº AMSTERDAM

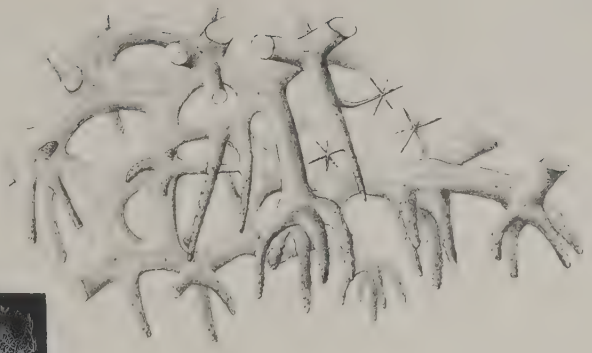
PLATE XXII.

Figs. 1—4. *Tretopleura candelabrum* n. g., n. sp.
(Continued from Pl. XXI).

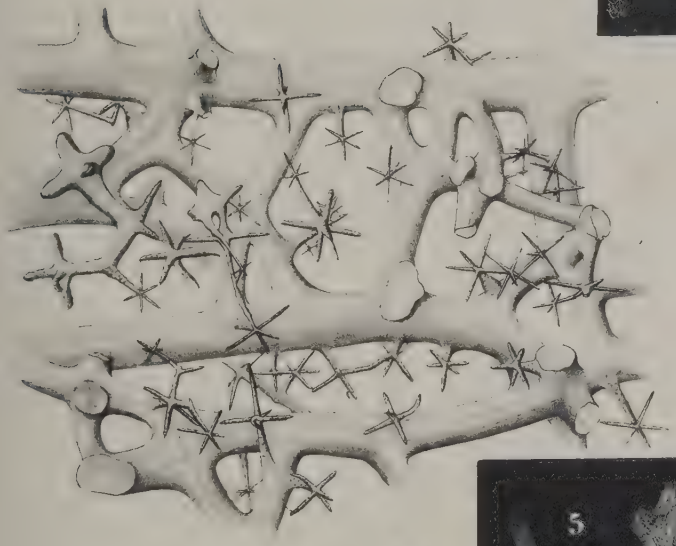
Fig. 1. A small part of a longitudinal section through wall (photograph of a hand-drawing), showing the arrangement of dictyonal fibers. Above, the dermal side with swollen spikes; below, the gastral side with exhalent canals. × about 6.
Fig. 2. Dermal spikes seen sideways. From a section. × 70.
Fig. 3. Gastral spikes seen sideways. From a section. × 70.
Fig. 4. A small part of the middle of a longitudinal section through wall, showing some longitudinal dictyonal fibers connected by reticulating beams. Beams and fibers with greatly swollen axial canal. × 70.

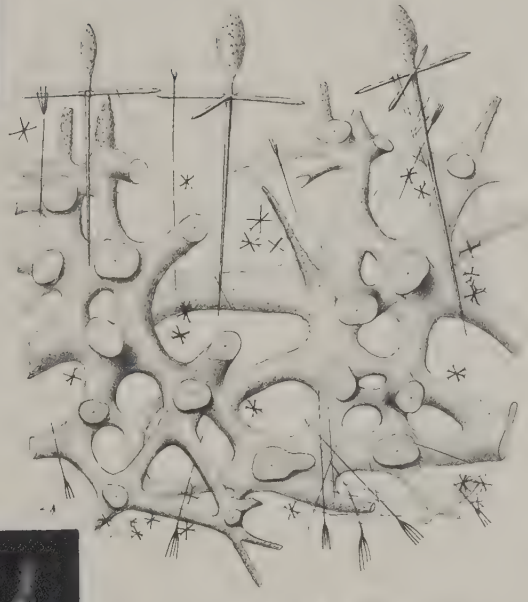
Figs. 5—12. *Sclerothamnopsis schulzei* n. sp.

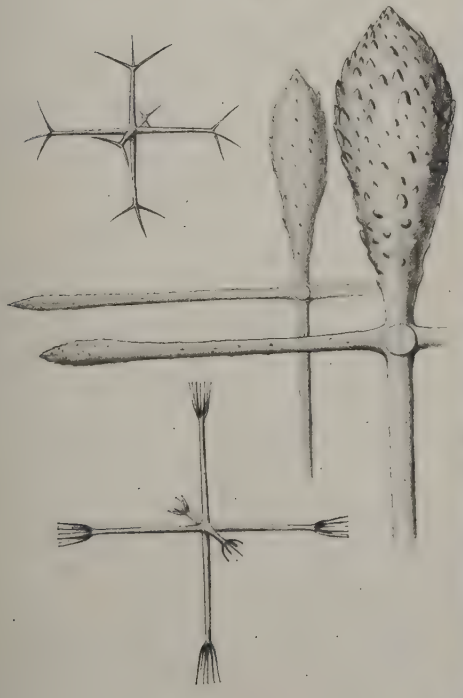
Fig. 5. Some of the fragment from Stat. 226. Natural size.
Fig. 6. A small part of a cross-section through wall. Partly constructed. Above, dermal surface. × 70.
Fig. 7. A small part of cleaned dictyonal skeleton seen on gastral surface and showing some gastral spikes. × 70.
Fig. 8. Distal end of a large and a small scopule. × 440.
Figs. 9, 10. Oxyhexasters. × 440.
Fig. 11. Parts of a large and a small dermal pinule. × 300.
Fig. 12. Tylohexaster of rare occurrence. × 440.

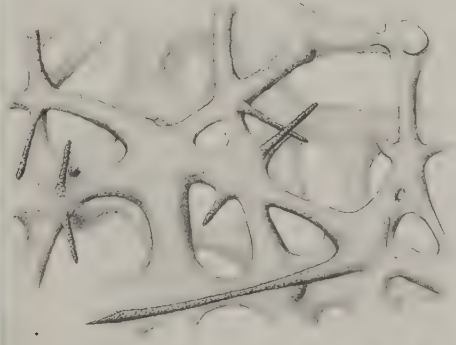


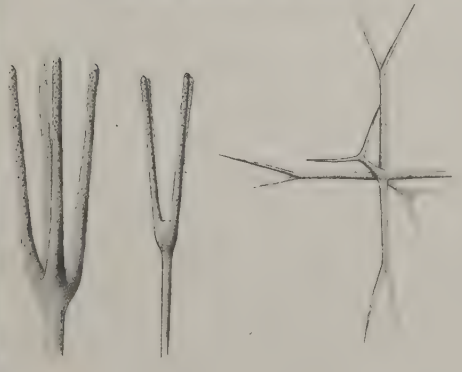
1.











HELIOTYPIE, L. VAN LEER & Cº AMSTERDAM

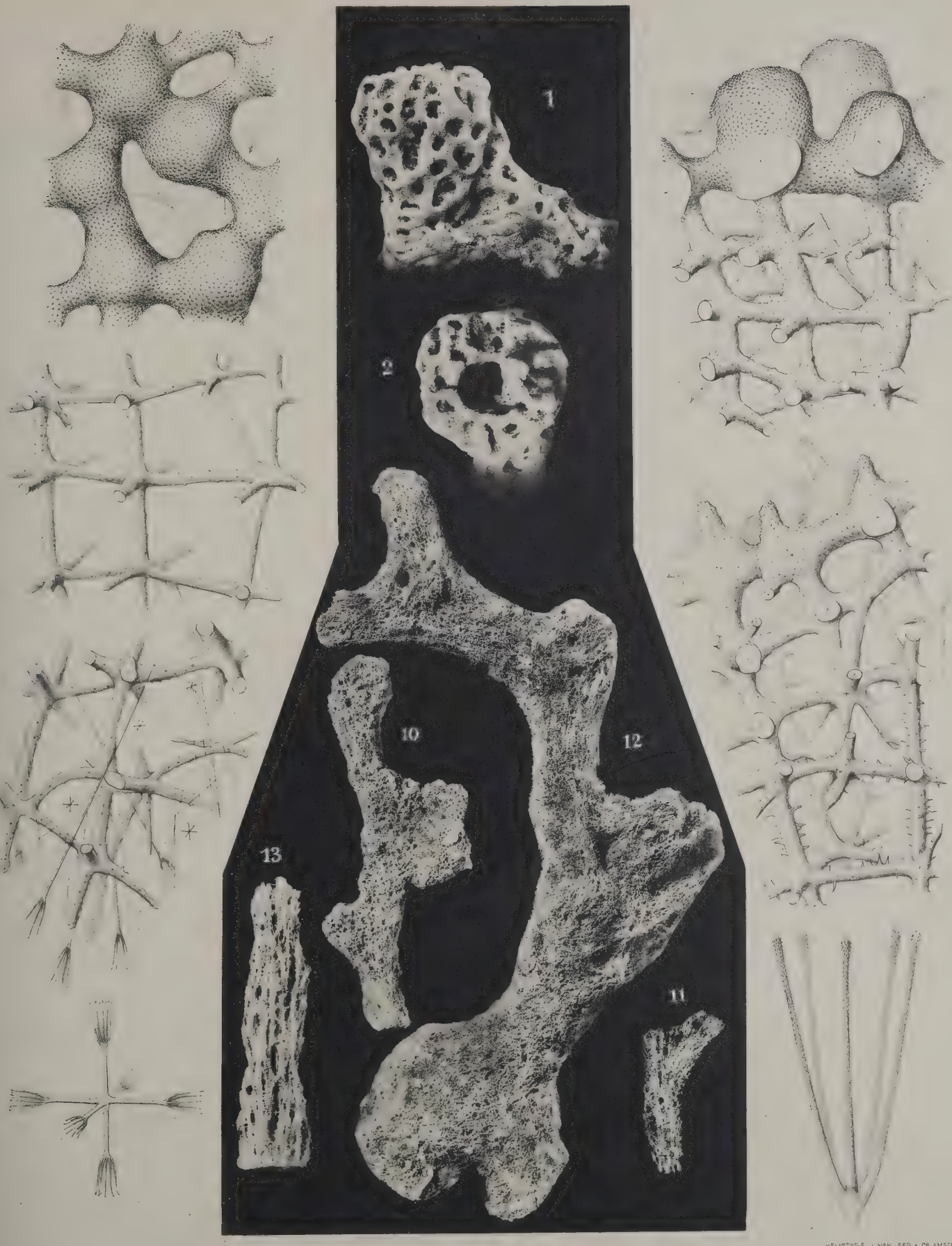
PLATE XXIII.

Figs. 1—9. *Psilocalyx wilsoni* n. g., n. sp.

Fig. 1. The type specimen in side view. From Stat. 267. Natural size.
Fig. 2. The same specimen viewed from above. Natural size.
Fig. 3. External surface of the dictyonal skeleton, showing excessive swelling of dermal spikes and externalmost dictyonal beams. × 70. This figure, as also figs. 4—9, drawn from preparations of the type specimen shown in figs. 1, 2.
Fig. 4. Peripheral part of a section of the skeleton. Above, external surface. × 70.
Fig. 5. A part of another section of the skeleton. Above, external surface, close inside an ostial aperture. × 70.
Fig. 6. Dictyonal framework from inner parts of a skeletal septum. × 70.
Fig. 7. From deep parts of skeletal wall. Below, gastral surface. × 70.
Fig. 8. A discohexaster. × 450.
Fig. 9. Head of a scopule. × 450.

Figs. 10—13. *Sclerothamnus clausi* Marshall.

Fig. 10. A fragment of branch with loose spicules preserved. From Stat. 260. Natural size. The figure, when examined under the lens, will show the dermal lattice in parts.
Fig. 11. A fragment of macerated skeleton, representing probably a part of branch near its free end; split longitudinally and photographed on the sectional surface. From Stat. 260. Natural size.
Fig. 12. A large dead stem, with basal expansion at the lower end. From Stat. 305. Reduced to $^3/_4$ natural size.
Fig. 13. A fragment of a completely macerated branch. From Stat. 156. Natural size.



HELIOTYPIE, L VAN LEER & Cº AMSTERDAM

PLATE XXIV.

Figs. 1—12. *Rhabdodictyum kurense* n. sp.

Fig. 1. A macerated but apparently nearly complete stock. From Stat. 251. Natural size.
Fig. 2. A fragment representing the oscular end of a tubular branch. From the same station. Natural size.
Fig. 3. The largest fragment from the same station, in lateral view. Natural size.
Fig. 4. Skeleton looked at from the dermal side; three dermalia drawn in. × 70.
Fig. 5. Dictyonal fibers and beams of the gastral surface. × 70.
Fig. 6. A dermal spike, showing peculiar tuberculation. × 100.
Fig. 7. A dermalia. × 200.
Fig. 8. A spirodiscohexaster. × 440.
Figs. 9—12. Discohexasters of rare occurrence. × 440.

Figs. 13—16. *Myliusia callocyathus* Gray.

Fig. 13. A specimen from Stat. 251 in lateral view. Natural size.
Fig. 14. Occular end of the same specimen. Natural size.
Fig. 15. Another specimen from the same station in lateral view. Natural size.
Fig. 16. Dictyonal skeleton, showing beams with characteristic tuberculation. Above, external most beams and nodes. × 100.

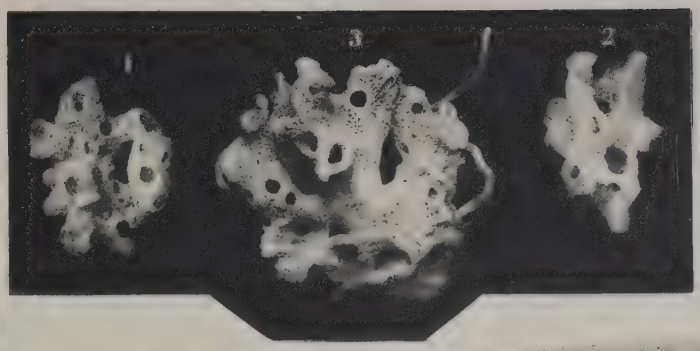
Figs. 17—19. *Myliusia verrucosa* n. sp.

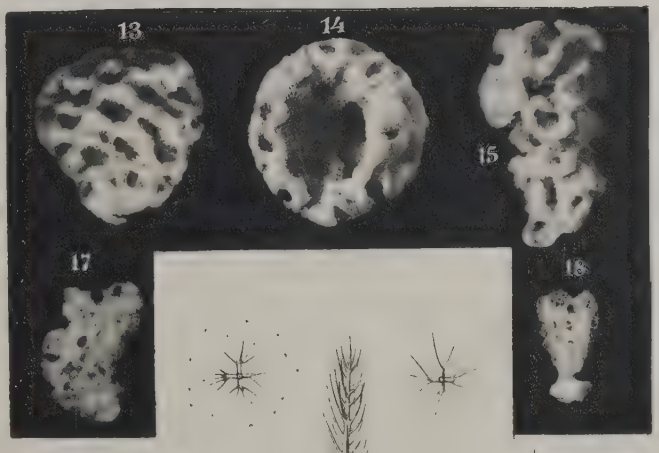
Fig. 17. A specimen from Stat. 97 in lateral view. Natural size.
Fig. 18. Another specimen from the same station, also in lateral view. Natural size.
Fig. 19. Dictyonal skeleton looked at from the dermal side. × 70.

Figs. 20—30. *Aphrocallistes beatrix* Gray.

Illustrating structure and spicules of a specimen from Stat. 12, Bali Sea. Scopules from the same specimen are shown in Pl. XXV. figs. 2 and 3.

Fig. 20. Dictyonal septum seen surface on. × 80.
Fig. 21. A pinular dermalia. × 325.
Fig. 22. A regular discohexaster. × 325.
Fig. 23. A regular oxyhexaster. × 325.
Figs. 24—30. Various forms of elongate hemi-oxyhexasters.
Figs. 28—30. Represent rare varieties of same. × 325.





HÉLIOTYPIE, L VAN LEER & C° AMSTERDAM

PLATE XXV.

Figs. 1—11. *Aphrocallistes beatrix* Gray.

Fig. 1. Cleaned skeleton of one of the fragments from Stat. 12, Bali Sea. Natural size.
Figs. 2, 3. Two forms of scopule from a specimen (the same as that from which Pl. XXIV, figs. 20—30 were taken) from Stat. 12. × 325.
Fig. 4. A washed-out specimen from Stat. 251, Banda Sea. Nat. size.
Fig. 5. A specimen from Stat. 177, Ceram Sea, from which were taken the following figs. 6—11. Natural size.
Figs. 6, 7. Two forms of scopule. × 325.
Fig. 8. A regular oxyhexaster. × 325.
Figs. 9, 10. Regular discohexasters, the common form of rosettes. × 325.
Fig. 11. Pinular dermalia. *c—e*. The commonest form. × 325.

Figs. 12—25. *Aphrocallistes beatrix orientalis* Ijima.

Fig. 12. A specimen from Stat. 312, Bali Sea, from which were taken the following figs. 13—17. Natural size.
Figs. 13, 14. Two forms of scopule. × 325.
Fig. 15. An elongate hemidiscohexaster. × 325.
Fig. 16. Another hemidiscohexaster with axial canals drawn in. × 490.
Fig. 17. Dictyonal septum, seen surface on. × 80.
Fig. 18. A specimen from Stat. 256, Kei Islands, from which were taken the following figs. 19—25. Natural size.
Fig. 19. Dictyonal septum, seen surface on. × 80.
Figs. 20, 21. Two forms of scopule. × 325.
Fig. 22. Part of an unusually large and thick-rayed pentactine dermalia. × 325.
Fig. 23. Dermalia of ordinary size; one simply pentactine, others hexactine and pinular. × 325.
Fig. 24. A regular discohexaster. × 325.
Fig. 25. An elongate hemidiscohexaster. × 325.

HELIOTYPIE, L VAN LEER & Cº AMSTERDAM

PLATE XXVI.

Figs. 1—16. *Aulocystis zitteli sibogæ* n. subsp.

Fig. 1. A specimen (A) from Stat. 289, with external covering layer nearly completely preserved. Seen from above. Natural size.
Fig. 2. Another specimen (B) from the same station, seen from above; the covering layer extensively fallen off. *2a*, the same specimen seen from below. Natural size.
Fig. 3. An intermedial oxyhexactin. × 400.
Fig. 4. A spherical discohexaster. × 400.
Fig. 5. Same with much thinner rays. × 400.
Fig. 6. A lophodiscohexaster. × 400.
Fig. 7. Another lophodiscohexaster with narrower terminal umbels. × 400.
Fig. 8. A graphiocome, with scleroblast nuclei in the angles between principals. × 400.
Fig. 9. Remnant of a broken up graphiocome; rhaphidial terminals sticking out almost radially from the sac in which the rosette is contained. × 400.
Fig. 10. Dermalia and prostalia (both pentactine) along the junction line of tube-wall and external covering layer. × 100.
Fig. 11. Spicules of the external covering layer seen surface on. × 100.
Fig. 12. Part of dictyonal skeleton and some loose spicules. Above, the dermal layer. × 100.
Fig. 13. A young lychnisc, still unconnected. From a fragment of tube margin obtained at Stat. 289. × 150.
Fig. 14. One of the smallest specimens from Stat. 260. Attached to a piece of coral. Natural size.
Fig. 15. A medium sized specimen from the same station. Natural size.
Fig. 16. A small specimen from the same station, with indication of developing covering layer in the lower parts. Natural size.

Figs. 17—20. *Diapleura maasi* n. g., n. sp. From Stat. 251.

Fig. 17. A specimen in side view. Natural size.
Fig. 18. Another specimen cut transversely and seen on the surface. Natural size.
Fig. 19. A still another specimen longitudinally cut open. Natural size.
Fig. 20. Part of the dictyonal skeleton. Above, as seen by reflected light; below, as seen in optical section. × 100.

Fig. 21. *Aulocystis zitteli zitteli* (Marsh. & Mey.)?

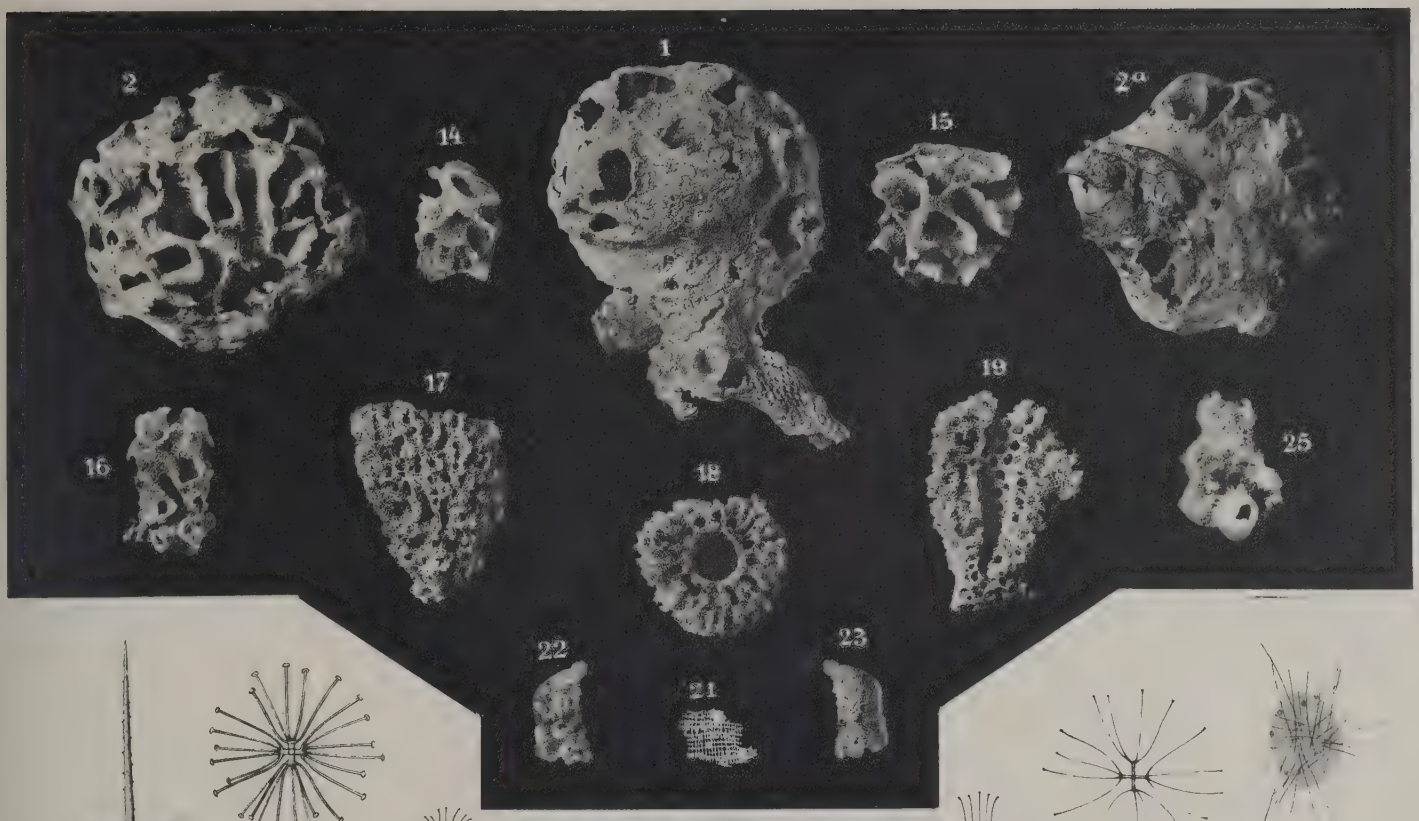
Fig. 21. A small piece of washed-out dictyonal skeleton. Stat. 59. Natural size.

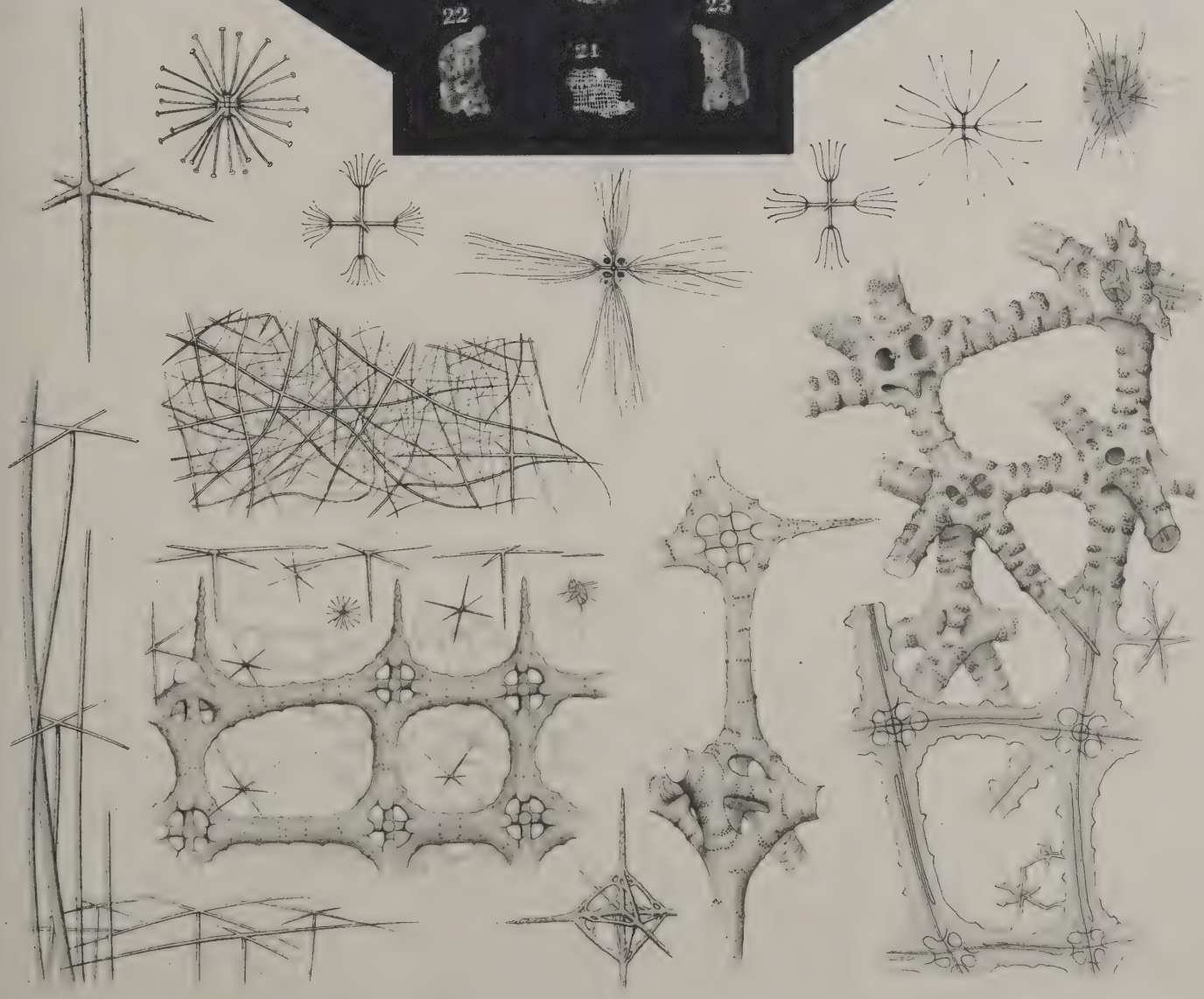
Figs. 22—24. *Aulocystis* sp. From Stat. 97.

Fig. 22. Fragment of tube wall, seen external surface on. Natural size.
Fig. 23. Same fragment seen internal surface on. Natural size.
Fig. 24. Dictyonal beams and lychniscs from the same fragment. The upper lychnisc as seen in optical section. × 100.

Fig. 25. *Aulocystis* sp. From Stat. 306.

Fig. 25. Fragmentary specimen seen dermal surface on. Natural size.





LITH. D^TYPIE L VAN LEER & C^o AMSTERDAM

THE PORIFERA OF THE SIBOGA-EXPEDITION